



# **ES-3850 ATM-Ethernet Workgroup Switch User's Manual**

MANU0058-01 - July, 1997

Software Version 4.0.2

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## ***FCC CLASS A NOTICE***

WARNING: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void this user's authority to operate this equipment.

NOTE: The ES-3850 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This digital apparatus does not exceed the Class A limits for radio noise emissions interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

## ***CERTIFICATIONS***

ETL certification to UL 1950. ETL certification to CSA 950.

CE Mark of European Conformity EN55022, EN60950, and EN50082-1.

Japan VCCI conformity.

This equipment is in the First Class category (information equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council For Interference by Information Technology Equipment aimed at preventing radio interference in commercial and/or industrial areas. Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

## ***TRADEMARKS***

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## GLOSSARY

# Preface

This manual provides the technical information needed to configure the ES-3850 ATM-Ethernet Workgroup Switch and the accompanying *ForeThought*<sup>™</sup> software. This document also provides general ATM information and general product information. This document was created for users with various levels of experience. If you have any questions or problems, please contact FORE Systems' Technical Support.

## Chapter Summaries

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**Chapter 1 - Introduction** - Provides an overview and explains the different applications suited to the ES-3850.

**Chapter 2 - Setup** - Describes handling and setup requirements of the ES-3850 prior to operation.

**Chapter 3 - Console Interface** - Describes how to manage the ES-3850 using a console management application via an ASCII command line interface. This interface allows the user to configure and troubleshoot an ES-3850 in an operational network.

**Appendix A - Alternate Software Download Procedure** - Describes how to download software to the ES-3850 using an ASCII terminal.

## **Technical Support**

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In the U.S.A., you can contact FORE Systems' Technical Support by any one of four methods:

1. If you have access to the Internet, you may contact FORE Systems' Technical Support via e-mail at the following address:

**support@fore.com**

2. You may FAX your questions to "support" at:

**412-742-7900**

3. You may send questions, via U S Mail, to the following address:

**FORE Systems, Inc.**

**1000 FORE Drive**

**Warrendale, PA 15086-7502**

4. You may telephone your questions to "support" at:

**1-800-671-FORE or 412-635-3700**

Technical support for non-U.S.A. customers should be handled through your local distributor.

No matter which method is used for technical support, please be prepared to provide your support contract ID number, the serial number(s) of the product(s), and as much information as possible describing your problem/question.

## Typographical Styles

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Throughout this manual, all specific commands meant to be entered by the user will appear on a separate line in bold typeface. In addition, use of the Enter or Return key will be represented as <ENTER>. The following example demonstrates this convention.

```
cd /usr <ENTER>
```

Commands or file names that appear within the text of this manual will be represented in the following style: "...the *fore\_install* program will install this distribution".

As in the following example, any messages that appear on your screen during software installation and network interface administration will appear in Courier font to distinguish them from the rest of the text.

```
.... Are all four conditions true?
```

## Important Information Indicators

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To call your attention to safety and otherwise important information that must be reviewed to insure correct and complete installation, as well as to avoid damage to the *ForeRunner* ES-3850 or your system, FORE Systems utilizes the following *WARNING/CAUTION/NOTE* indicators.

**WARNING** statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a **WARNING** statement until the indicated conditions are fully understood or met. This information could prevent serious injury to the operator, damage to the *ForeRunner* ES-3850, the system, or currently loaded software, and will be indicated as follows:

### **WARNING!**



Hazardous voltages are present. To lessen the risk of electrical shock and danger to personal health, follow the instructions carefully.

Information contained in **CAUTION** statements is important for proper installation/operation. **CAUTION** statements can prevent possible equipment damage and/or loss of data and will be indicated as:

**CAUTION**



You risk damaging your equipment and/or software if you do not follow these instructions.

Information contained in **NOTE** statements has been found important enough to be called to the special attention of the operator and will be set off from the text as follows:

**NOTE:** The ES-3850 must be kept at least 30 mm from any other ES-3850. This is the distance measured from the left, right or back. The units may be stacked one on top of the other.



## Safety Agency Compliance

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This preface provides safety precautions to follow when installing a FORE Systems, Inc., product.

### Safety Precautions

For your protection, observe the following safety precautions when setting up your equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of your power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to your equipment.

### Symbols

The following symbols appear in this book.

#### CAUTION



If instructions are not followed, there is a risk of damage to the equipment.

#### WARNING!



Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

## Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. FORE Systems, Inc., is not responsible for regulatory compliance of a modified FORE product.

## Placement of a FORE Systems Product

### CAUTION



To ensure reliable operation of your FORE Systems product and to protect it from overheating, openings in the equipment must not be blocked or covered. A FORE Systems product should never be placed near a radiator or heat register.

## Power Cord Connection

### WARNING!



FORE Systems products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug FORE Systems products into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.

### WARNING!



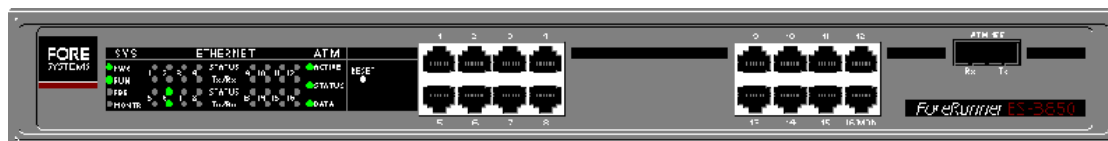
Your FORE Systems product is shipped with a grounding type (3-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

# CHAPTER 1

## Introduction

### 1.1 Overview of the ES-3850

As networks migrate from shared media LANs based on hubs and routers to switched media LANs based on LAN switches and ATM switches, deploying the ES-3850 becomes key to not only boosting performance but also expanding into ATM backbones. With 16 switched Ethernet ports connecting to existing LAN segments, the ES-3850 helps users realize the scalability of cell switching in ATM backbone networks while protecting their current investment of Ethernet cabling and network adapter cards.



**Figure 1.1** - The ES-3850

The ES-3850 has a 155 Mbps OC-3c ATM interface that complies with the ATM Forum's UNI (User Network Interface) 3.x. The interface can be configured to support either SONET OC-3c or (in Europe) SDH STM-1, the 155 Mbps over fiber standards.

The following models also are available:

- 16-port Ethernet Single-mode (long reach; 20 kms), with an OC-3c ATM interface.
- 16-port Ethernet Multi-mode, with an OC-3c ATM interface and redundant PHY connectors.
- 16-port Ethernet Single-mode, with an OC-3c ATM interface and redundant PHY connectors.

## **1.2 LAN Emulation**

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The ES-3850, running FORE's *ForeThought* software, supports the ATM Forum's LAN Emulation 1.0 specification providing LANs with the ability to connect to ATM networks, thus allowing the transparent operation of all LAN protocols (such as IP, IPX, AppleTalk, or DECnet).

The ES-3850 supports up to 16 LECs (LAN Emulation Clients), allowing users connected to participate in up to 16 emulated LANs.

The ES-3850 encapsulates the Ethernet packets into ATM Cells using the AAL5 protocol sublayer. The LEC component of the ES-3850 maps IEEE 802 MAC level addresses into ATM addresses and establishes a point-to-point ATM virtual circuit connection to other LECs on ATM networks, enabling the transfer of data between the LECs.

## 1.3 Bridging Capabilities

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The Ethernet ports and the associated emulated LAN at the ATM port are interconnected via bridged links. Together, they make up a multi-port bridge, such that each virtual network is handled by a 'sub-bridge'. The sub-bridges implement the IEEE 802.1d Spanning Tree protocol, whose implementation increases the reliability of the network by preventing illegal topologies and consequent undesirable effects such as broadcast storms.

## **1.4 Monitoring Port**

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The position of the ES-3850 at the interface between the Ethernet and ATM networks makes it an ideal point at which to gather statistics and monitor network performance. Ethernet port 16 of the ES-3850 can act as a monitoring port to which a network analyzer such as a Sniffer can be connected, while any one of the other 15 Ethernet segments can be selected for monitoring. Traffic on the monitored port is duplicated and sent to the monitoring port.

The monitored port can be easily changed from the management console, thereby allowing the manager to monitor all of the Ethernet segments. Port 16, while in monitor mode, cannot be used to send regular data.

## 1.5 Dual ATM Port Units

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An ES-3850 with dual ATM ports (Single-mode and Multi-mode) will always use the primary link to send and receive the traffic. It will switch to the secondary link only when the primary link fails. In order to make this happen smoothly, the links have to be connected to switch(es) such that they can locate the LANE Services without any problem.

**NOTE:** For example, if the links are connected to two different switches, then those two switches have to be connected to each other by an NNI link in order to reach the services when one of the links fail.

In addition, the secondary link will remain active even when the primary link comes back alive after a brief failure. Traffic will be routed to the primary only when the secondary link fails.

## **1.6 Full Manageability**

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The ES-3850 contains an SNMP agent, making it fully manageable using either the ES-3850's console management application, or the MIB browsing facilities of the management platform. Virtual networks can be set up and network performance can be monitored and faults diagnosed by viewing statistical information for many ATM and Ethernet parameters. These include Ethernet Port Counters, SONET Counters, Bridge Port Counters and ATM Interface Counters.

Upgrades to the ES-3850 can be downloaded to the unit over the Ethernet using an ASCII terminal, or via the console management application.



## 1.7 ES-3850 Applications

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ES-3850 can be used as a LAN access switch to an ATM network or as a gateway to an ATM backbone, or as a high-speed ATM tunnel.

### 1.7.1 LAN Access Switch Gateway to ATM

If your network already includes a central ATM switch, the ES-3850 can connect up to 16 Ethernet LANs to your ATM backbone. Virtual networks continue seamlessly from Ethernet to ATM, and back again. In this configuration, the ES-3850 also serves as an STA bridge with standard bridging functionality.

### 1.7.2 ATM Backbone Tunnel

Connect two ES-3850 units back-to-back to create a high-speed ATM tunnel. The data from all 16 Ethernet LANs can be transferred across the ATM line simultaneously. In this configuration, the ES-3850 also serves as an STA bridge with standard bridging functionality.



The following information describes the handling and setup of the ES-3850 prior to operation.

## 2.1 Installation Overview

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The installation of the ES-3850 involves the following:

- Unpacking and inventorying the unit.
- Site planning.
- Connecting the cables and ASCII terminal.
- Configuring the essential parameters of the ES-3850.

**NOTE:** It is very important to read through the ENTIRE installation procedure before attempting to power on the unit.

## 2.2 Unpacking

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Upon receipt of, and before opening the ES-3850, inspect the package for any damage that might have occurred during shipping. If the package shows any signs of external damage or rough handling, notify your carrier's representative.

When unpacking the ES-3850 be sure to keep all original packing materials. They might be needed for storing, transporting, or returning the product.

### CAUTION



All products returned to FORE Systems, under warranty, must be packed in their original packing materials.

### 2.2.1 Inventorying the Unit

A complete inventory of the ES-3850 should be done before any power is applied to the unit. The ES-3850 package should include the following:

- ES-3850 unit
- Rack-mount brackets
- Serial cable
- Power cord
- Release Notes
- ES-3850 User's Manual (this document)

## 2.3 Site Planning

---

Place the ES-3850 unit in a site with the following conditions:

- Temperature: 0-40 degrees Celsius
- Humidity: 5-95% non-condensing
- Power Supply: 110/220 VAC, 50/60 Hz
- Proper grounding
- Proper mounting

**NOTE:** The ES-3850 must be kept at least 30 mm from any other ES-3850. This is the distance measured from the left, right or back. The units may be stacked one on top of the other.

## 2.4 Connecting the Cables

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### 2.4.1 Connecting Ethernet

The ES-3850 can connect up to 16 Ethernet LANs or workstations. In addition, an RMON probe or LAN analyzer may be connected to port number 16. To connect your ES-3850 unit to Ethernet:

1. Prepare standard 10BASE-T cables (twisted pair, 1-to-1).

**NOTE:** If connecting to a workstation, a straight through cable is used (1-1, 2-2, 3-3, 6-6). If connecting to another hub device, a crossover cable is required (1-3, 2-6, 3-1, 6-2).

2. Snap the cables into the Ethernet ports on the front panel of your ES-3850 unit. If you wish, to monitor the Ethernet ports, connect an RMON probe or LAN analyzer to port number 16.
3. Snap the other ends of the cables into Ethernet LANs, Ethernet workstations, or an RMON probe or LAN analyzer.

### 2.4.2 Connecting ATM Cables

To connect your ES-3850 unit to an ATM backbone switch or to another ES-3850 unit:

1. Prepare a multimode optical cable (Tx Rx) with SC connectors.
  - a. You may want to mark the ends of the cable so you know which wire is which.
  - b. Remove the optical connector protective cover.
3. Snap the cable into the ATM port on the right side of the front panel of your ES-3850 unit.
4. Snap the other end of the cable into the ATM switch or the ATM port of the second ES-3850 unit. Be sure that each cable connects to Tx on one end and Rx on the other.

### 2.4.3 Connecting the Terminal

Basic configuration of your ES-3850 unit can be performed either of two ways: using a standard ASCII terminal, or using the console management application.

To connect an ASCII terminal to the ES-3850 terminal port:

1. Configure the terminal: 9600 baud, 8 data bits, 1 stop bit, no parity, xon/xoff flow control.
2. Plug the included console cable into the terminal port located on the back of the ES-3850 unit.
3. Connect the other end of the cable to the terminal.

**NOTE:** Refer to the Configuration section of Chapter 3 for information on using the console management software for basic configuration.

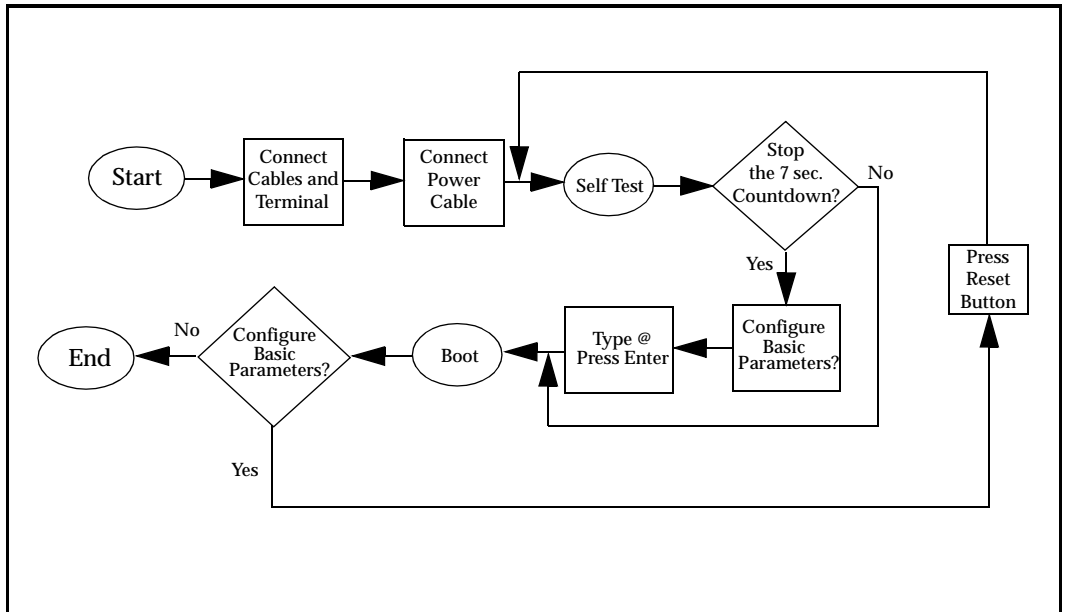
### 2.4.4 Console Serial Cable Pinouts

**Table 2.1** - Console Serial Port Pinouts

Pin Number	Signal Mnemonic	Signal Name
1	DSR	Data Set Ready
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DCD	Data Carrier Detect
7	CTS	Clear to Send
8	RTS	Request to Send
9	-	Not Connected

## 2.5 Configuring Basic Parameters

Several basic parameters must be configured via the ASCII terminal before ES-3850 will function properly. The following flowchart summarizes the procedure for configuring basic parameters.



**Figure 2.1** - Installation and configuration flowchart for the ES-3850



## 2.5.1 Accessing Basic Parameters

1. Prepare the power cord supplied with the unit.
2. Plug the power cord into the 110/220 VAC, 50/60 Hz power source.
3. While watching the terminal screen, plug the other end of the cord into the AC inlet located on the ES-3850 back panel. Make sure the power cord is fully seated. The unit is automatically powered up when the power cord is plugged in. As the unit undergoes automatic self-tests, the LEDs will light sequentially, and the results of the test will be displayed on the terminal screen.
4. Upon completion of the self-tests, a seven second countdown to auto-boot will appear on the terminal screen, and then the following message:

Press any key to stop auto-boot

5. Press any key to stop the countdown so you can configure the basic parameters. A prompt will appear on the terminal screen:

[Boot] :

**NOTE:** If you did not stop the countdown, and you wish to configure basic parameters, press the Reset button on the front panel of the ES-3850, or disconnect and reconnect the power plug, and try again.

6. At the [Boot] : prompt, type p and press <Enter> to view the basic configuration parameters with their current values, or type c and press <Enter> to change the values.

On the terminal screen, the basic parameters appear.

```
Name :Jonathan
IP Address :198.10.24.5
IP Network Mask :255.255.255.0
Server Name :Cobra
Server IP address :198.11.21.116
Gateway IP address :
Boot File Name :/users/jimmy/es3850/vwi960.axs/boot
User name :software
User password :lucky
Boot Device :Network
Boot Port :1
Protocol :FTP
TFTP Mode :CLIENT
Load Into :RAM
Manager IP Address :198.11.10.115
Community :public
Own ATM Prefix :47:00:79:00:00:00:00:00:00:00:00:00
LECS ATM
Address:47:00:79:00:00:00:00:00:00:00:00:00:a0:3e:00:0
0:00:00
LES ATM Address
:47:00:79:00:00:00:00:00:00:00:00:00:a0:5e:00:00:00:00
Point to Point Mode :y,0.100
OC3 Interface :SONET
Management ViNet :0
```

**Figure 2.2 - Basic Parameters Screen**

## 2.5.2 Setting Basic Parameters

In the Basic Parameters screen, several essential parameters must be set for the ES-3850 unit to function properly. Once you have set these parameters correctly, the unit will have all the capabilities described in this manual.

**NOTE:** These basic parameters also can be set using the console management application. Refer to the Configuration section of Chapter 3 for information on using the console management software for basic configuration. However, we suggest that basic configuration be done at the time of boot for ease and consistency.

The following is a list of the essential parameters which must be set:

<b>Name</b>	Name of the ES-3850 Unit.
<b>IP Address</b>	IP address of the ES-3850 Unit.
<b>IP Network Mask</b>	IP network mask of the ES-3850 Unit.
<b>Manager IP Address</b>	IP address of the SNMP management station. If there is no management station, this parameter may be ignored.
<b>Community</b>	Set the Community name for the device. If you change the Community name from the default public, the management station will not be able to interact with the ES-3850 until the management station has been configured with the new community name.
<b>Own ATM Prefix</b>	<p>13 octet ATM prefix of the ATM switch to which the ES-3850 unit is connected. This prefix is used to set the ATM address of the ES-3850 unit, and all devices connected to the same switch will have the same ATM prefix. The unit will get this prefix automatically via ILMI from the switch.</p> <p>If your ES-3850 unit is directly connected to a second ES-3850 unit (either back-to-back or through an ATM switch), you may ignore this parameter.</p>

<b>LECS ATM Address</b>	<p>ATM address of the LAN Emulation Configuration Server (LECS) to which the ES-3850 unit is to be connected. This parameter is determined by your ATM network setup. Normally this will be set to the well-known address of the LECS.</p> <p>If your ES-3850 unit is directly connected to a second ES-3850 unit (either back-to-back or through an ATM switch), you may ignore this parameter.</p>
<b>LES ATM Address</b>	<p>This is the ATM address of the LAN Emulation Server (LES). If the LECS is not running then you can configure this address so that the ES-3850 will use this to join an ELAN.</p>
<b>Point to Point Mode</b>	<p>Specifies whether you have connected the ES-3850 unit in back-to-back PVC mode or in LAN Emulation mode. Options are N for No or Y for Yes. If connected to an ATM network, the value should be set to N.</p> <p>If connected to another ES-3850 unit (either back-to-back or through an ATM switch) to create an ATM Permanent Virtual Circuit (PVC) link, the value should be set to Y.</p> <p>If you choose Yes, the default VPI/VCI values of the PVC appear. If you change them, ensure that the same values are set for both units.</p>
<b>OC3 Interface</b>	<p>Set the protocol to either SONET (Press 1) or SDH (Press 0). If your ES-3850 unit is connected point-to-point to a second ES-3850, be sure to set the same protocol for both units. If your ES-3850 is connected to an ATM switch, set the protocol to match the switch.</p>
<b>Management ViNet</b>	<p>Set the number of the virtual network of the management station (0 to 255). 0 is the Generic ViNet, 255 is the Global ViNet.</p>

### 2.5.3 Resetting the Parameters to Default

To recover from an undesirable configuration, you can reset the parameters to their factory default values. To reset all basic parameters to their factory default values at the boot terminal prompt, press **Ctrl-E**. You will be asked to confirm, which you should do by pressing **y**.

### 2.5.4 Returning to Auto-boot

To have the ES-3850 unit continue the automatic boot process when you are finished configuring the basic parameters:

- At the prompt, type **@** and press **<Enter>**.
- The ES-3850 will now be ready for use.

## 2.6 Verifying Proper Connection And Configuration

---

When the ES-3850 unit has finished the boot process check that the front panel LEDs are lit as indicated in the following tables.

**Table 2.2 - Front Panel SYS LEDs**

LED Indicator	Status	Meaning
PWR	On	The unit is powered up.
RUN	On	Lights 20 seconds after power-up, indicating that software has been loaded and unit is operational.
ERR	Off	No error.
MONTR	On	Port 16 has been enabled as a monitoring port.

**Table 2.3 - Front Panel ETHERNET LEDs**

LED Indicator	Status	Meaning
STATUS	On	Port is enabled and the cable is connected.
	Off	Port is disabled (via the ES-3850 console application).
	Blinking	Port is enabled but cable is not connected.
Tx/Rx	On	Data is being transmitted from or received at the port.

**Table 2.4 - Front Panel ATM LEDs**

<b>LED Indicator</b>	<b>Status</b>	<b>Meaning</b>
ACTIVE	On	For units with 1 ATM port this LED is always On.
STATUS	On	Port is enabled and the cable is connected.
	Off	Port is disabled (via the ES-3850 console application).
	Blinking	Port is enabled but cable is not connected.
DATA	On	Data is being transmitted from or received at the ATM port.

## 2.7 Software Upgrades

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Future software upgrades for the ES-3850 can be downloaded to the unit over the Ethernet using an ASCII terminal, or via the console management application. Please refer to Appendix A for information on downloading new software using an ASCII terminal. Please refer to the Configuration section of Chapter 3 for information on using the `boot` menu of the console management application for downloading new software.



# **CHAPTER 3** Console Interface

The ES-3850 ATM-Ethernet Workgroup Switch may be managed using a console management application via an ASCII command line interface. This console application may be accessed via telnet, or by connecting a serial cable to the RS-232 port on the ES-3850. This interface allows the user to configure and troubleshoot an ES-3850 in an operational network.

Two levels of password access provide network security. An administrator password allows read/write access to the unit, while a user level password allows read-only access to the unit. The command shell is not case-sensitive, so any of the commands may be entered in upper or lower case.

## **3.1 Accessing the Terminal Interface of the ES-3850**

---

You can access the menu system via a serial terminal connected to the ES-3850 RS-232 port, or via telnet from an IP station on the attached network.

**NOTE:** The terminal application supports two logins at a time. If access is attempted via both telnet and the serial port, only one administrator may be logged in (the first one to do so).

The access rights, tree structure, and console prompt will change to reflect whether the current session is logged in as an administrator or a user.

### **3.1.1 Administrator Login**

The administrator login will allow full read/write access to the ES-3850, allowing all configuration, statistics, and operation parameters to be viewed and/or modified. The full tree of command options is available in this mode. The default user id and password for administrator level access are “user” and “privateadmin”, respectively. The prompt for the administrator mode is as follows (note the \$):

```
ES-3850::host:$
```

**NOTE:** If the Administrator session enabled via telnet or serial interface is idle for 5 minutes, the session is automatically terminated.

### **3.1.2 User Login**

The user login will display only a subset of the command tree, and further limit all permissions to read only. The default user id and password for user level access are “user” and “privateuser”, respectively. The login prompt for the user mode is as follows (note the %):

```
ES-3850::host:%
```

### 3.2 Navigating the Console Interface

---

The ES-3850's console application has a single root menu that provides a number of commands. Some of those commands, in turn, call submenus which provide a number of subcommands. Commands that are submenus are immediately followed by a ">" symbol. At any given time, the user works within a particular submenu which is indicated by the prompt. The user can traverse a submenu one level at a time, or can traverse a number of levels simultaneously if the entire command string is known.

Additionally, the user only needs to enter the minimum number of letters in a command which would make the command unique to that level. For example, to show the current configuration of the SNMP manager, enter the following at the prompt:

```
ES-3850::host% config snmp man show
```

```
SNMP Managers Table
```

```
-----
```

Manager	Address	Community	Traps	Status
1	192.114.60.11	public	On	permanent

```
ES-3850::host%
```

The minimum number of letters entered must also distinguish the command from global commands, such as top or up. For example, you would have to enter topo to distinguish topology from the global command top.

Upon login, the user is positioned at the top level of the tree. The user will “walk” the command tree to perform a particular operation. There are commands available at each menu level to help the user navigate the menu tree.

These commands, available at all menu levels, are summarized as follows:

- Up**     The up command is available at all menu levels. This command allows the user to navigate the menu system by moving the user up one menu level at a time.
- Top**     The top command is available at all menu levels. This command allows the user to navigate the menu system by moving the user up to the top (root) level menu
- Exit**     The exit command closes the current session of the user interface and logs the current user off.
- ?**     The ? command may be typed at any menu prompt for a list of available commands or subcommands.

In addition, the following keystrokes allow you to scroll through previously executed commands:

- <Esc> <K>**     Press <Esc> <K> to scroll back through previously executed commands. Pressing <K> repeatedly takes you back one command at a time.
- <Esc> <J>**     Press <Esc> <J> to scroll forward through previously executed commands. Pressing <J> repeatedly takes you forward one command at a time.

### 3.3 Configuration

This section contains a description of the configuration commands. The main configuration menu can be found at the root level. There are several commands available under configuration. Commands that are submenus are immediately followed by a “>” symbol. Typing configuration ? at the prompt at the root level displays the configuration commands as follows:

ES-3850::host:\$

snmp>	eport>	elan>	atm>
show	boot>	ip>	vinet>
monitor>	lecs	les	aging_time
up	top	exit	?

Many of these commands have submenus which are described in the following sections.

#### 3.3.1 SNMP Parameters Configuration

Use the snmp submenu to configure SNMP parameters. The user can reach this level by typing snmp at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for snmp is displayed.

ES-3850::host:configuration:\$ snmp  
ES-3850::host:configuration:snmp:\$ ?

show	community	manager>	authentication
up	top	exit	?

The subcommands are defined as follows:

- Show**

This command shows the status of the SNMP subsystem of the ES-3850, including packets and traps in/out and whether authentication traps are enabled or disabled.
- Community**

This command allows a community string to be associated with a manager IP address. Note that the IP address must already be defined with the new command before the community command will operate.

<b>Manager</b>	Submenu to configure the SNMP manager.
<b>Authentication</b>	This command enables or disables authentication traps on the ES-3850.

### 3.3.1.1 SNMP Manager Configuration

Use the manager submenu to set the SNMP manager parameters on the ES-3850 unit. The user can reach this level by typing `manager` at the `snmp` menu level. Then, by typing `?` at the prompt, the list of available subcommands for manager configuration is displayed.

```
ES-3850::host:configuration:snmp:$ manager
```

```
ES-3850::host:configuration:snmp:manager:$ ?
```

show	new	delete	traps
up	top	exit	?

**New** This command allows a new manager IP address to be added to the ES-3850. When an IP address is added, a default community string of “public” is associated with it.

**Delete** This command allows the deletion of a specific manager IP address. The deletion takes effect upon the next reboot of the ES-3850.

**Traps** This command allows enabling or disabling of traps for a specific manager IP address. This action takes place immediately upon command entry.

**Show** This command displays the SNMP manager table for the ES-3850, and includes manager, IP address, community, traps, and status information.

### 3.3.2 Ethernet Port Configuration

Use the eport submenu to configure Ethernet port parameters. The user can reach this level by typing eport at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for Ethernet port configuration is displayed.

```
ES-3850::host:configuration:eport:$
ES-3850::host:configuration:eport:$ ?
```

```
state          cong_control    qos            stp>
show           up            top            exit
?
```

The subcommands are defined as follows:

- State**      The state command allows any Ethernet port to be enabled or disabled. This action takes place immediately upon command entry.
- Cong\_control**      The cong\_control command allows the “congestion” feature to be turned on or off for any Ethernet port on the ES-3850. This action takes place immediately upon command entry. The default value is enabled.
- QoS**      The qos (quality of service) command allows the polling interval to be set to normal or high for any Ethernet port on the ES-3850. This action takes place immediately upon command entry. The default qos is “normal”.
- STP**      This submenu allows the user to configure Spanning Tree Protocol parameters.



### 3.3.2.1 STP Parameter Configuration for Ethernet Ports

Use the stp submenu to configure Spanning Tree Protocol (STP) parameters for Ethernet ports. The user can reach this level by typing stp at the configuration:eport level. Then, by entering ? at the prompt, a list of available subcommands for the Spanning Tree Protocol is displayed.

```
ES-3850::host:configuration:eport:$ stp
ES-3850::host:configuration:eport:stp:$ ?
```

status	priority	path_cost	up
top	exit	?	

The subcommands are defined as follows:

- Status** The status command allows IEEE 802.1d Spanning Tree Protocol to be enabled or disabled for any Ethernet port on the ES-3850. This action takes place immediately upon command entry.
- Priority** The priority command allows the Spanning Tree Protocol priority to be set for any Ethernet port on the ES-3850. The range of allowed values is 0-255, with a default of 128. This action takes place immediately upon command entry.  
  
**WARNING:** The priority command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value of 128 to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.



**Path\_Cost**     The path\_cost command allows the Spanning Tree Protocol path cost to be set for any Ethernet port on the ES-3850. The range of allowed values is 0-65535, with a default of 100. This action takes place immediately upon command entry.

WARNING: The path\_cost command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value of 100 to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

3.3.3 ELAN Configuration

Use the elan submenu to configure ATM Forum emulated Ethernet LAN parameters. ELANs are the “emulated” Ethernet(s) on the ATM side of the ES-3850. The user can reach this level by typing elan at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for an ELAN is displayed.

```
ES-3850::host:configuration:elan:$
ES-3850::host:configuration:elan:$ ?
```

state	stp>	show	up
top	exit	?	

The subcommands are defined as follows:

- State**     Allows the user to enable or disable an ELAN. Required syntax is: state <elan name> (enable|disable.) This action takes place immediately upon command entry.
- STP**     This submenu allows the user to configure STP parameters for each defined ELAN on the ES-3850.



### 3.3.3.1 STP Parameter Configuration for ELANs

Use the stp submenu to configure Spanning Tree parameters for each defined ELAN on the ES-3850. The user can reach this level by typing stp at the configuration:elan level. Then, by entering ? at the prompt, a list of available subcommands for the Spanning Tree Protocol is displayed.

```
ES-3850::host:configuration:elan:stp:$  
ES-3850::host:configuration:elan:stp:$ ?
```

priority	path_cost	status	up
top	exit	?	

The subcommands are defined as follows:

**Priority** The priority command allows the Spanning Tree Protocol priority to be set for any ELAN that is defined on the ES-3850. The range of allowed values is 0-255, with a default of 128. This action takes place immediately upon command entry.

**WARNING:** The priority command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value of 128 to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

- Path\_Cost

The path\_cost command allows the Spanning Tree Protocol path cost to be set for any ELAN that is defined on the ES-3850. The range of allowed values is 0-65535, with a default of 10. This action takes place immediately upon command entry.
- WARNING: The path\_cost command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value of 10 to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.
- Status

The state command allows IEEE 802.1d Spanning Tree Protocol to be enabled or disabled for any ELAN that is defined the ES-3850. This action takes place immediately upon command entry.

3.3.4 ATM Parameter Configuration

Use the atm submenu to configure ATM parameters on the ES-3850, including point-to-point PVCs, RFC 1483 PVCs, and rate queues. The user can reach this level by typing atm at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for ATM parameters is displayed.

ES-3850::host:configuration:atm:\$  
ES-3850::host:configuration:atm:\$ ?

show	status	pvc>	rate>
lanem	up	top	exit
?			

The subcommands are defined as follows:

<b>Show</b>	The show command allows the current status of the ATM parameters to be displayed. Included are the status of the ATM port and whether the ES-3850 is in LAN Emulation mode (SVC's) or Point-to-Point mode (PVC).
<b>Status</b>	The status command allows the ATM port to be enabled or disabled on the ES-3850. This action takes place immediately upon command entry.
<b>PVC</b>	The pvc submenu allows the user to configure the VPI,VCI pair that this ES-3850 will communicate to a second ES-3850 over a PVC on the ATM port. This action takes place immediately upon command entry. This submenu also provides configuration for VPI, VCI pairs that support RFC 1483, bridging network interconnect traffic over the ATM AAL5 layer.
<b>Rate</b>	The rate submenu allows the user to assign a pvc to one of eight available rate queues.
<b>LANEM</b>	The LANEM command allows the ATM port of the ES-3850 to be set to operate in one of three modes: Point-to-Point mode using PVCs, PVCs supporting RFC 1483, or the ATM Forum LAN Emulation mode (SVC's) .

#### 3.3.4.1 PVC Parameter Configuration

Use the pvc submenu to configure VPI,VCI pairs that allow the ES-3850 to communicate over a PVCs on the ATM port. From this submenu, the user can create point-to-point PVCs as well as PVCs that support RFC 1483, bridging network interconnect traffic over the ATM AAL5 layer. The user can reach this level by typing pvc at the configuration:atm level. Then, by entering ? at the prompt, a list of available subcommands for the pvc menu is displayed.

```
ES-3850::11.1.1.39:configuration:atm:pvc$
ES-3850::11.1.1.39:configuration:atm:pvc$ ?
1483>          ptp          up          top
exit          ?
```

The subcommands are defined as follows:

- 1483** The 1483 submenu allows the user to configure a VPI,VCI pair that will support RFC 1483, bridging network interconnect traffic over the ATM AAL5 layer; assign a 1483 PVC to a rate queue, and delete a 1483 PVC.
- PTP** The ptp command allows the user to configure the VPI,VCI pair that this ES-3850 will communicate to a second ES-3850 over a PVC on the ATM port. This action takes place immediately upon command entry.

**3.3.4.2 1483 Parameter Configuration**

Use the 1483 submenu to configure PVCs that support RFC 1483, bridging network interconnect traffic over the ATM AAL5 layer. The user can reach this level by typing 1483 at the configuration:atm:pvc level. Then, by entering ? at the prompt, a list of available subcommands for the pvc menu is displayed.

```
ES-3850::11.1.1.39:configuration:atm:pvc$ 1483
ES-3850::11.1.1.39:configuration:atm:pvc:1483$ ?
show          new          rate          delete
up            top          exit          ?
```

The subcommands are defined as follows:

- Show** The show command allows the current status of the 1483 PVC parameters to be displayed.
- New** The new command allows the user to create a new 1483 pvc. The following parameters are required for the successful creation of a 1483 PVC: <vilan id> <vpi> <vci>. The maximum number of 1483 PVCs allowed is 48.
- Rate** The rate command allows the user to assign a 1483 pvc to one of eight available rate queues. The following parameters are required for the successful application of rate queues: rate <pvc id> (1|2|3|4|5|6|7|8). The rate queues should already be defined at the configuration:atm:rate level.



**Delete** The delete command allows the user to delete an existing 1483 pvc. The following parameters are required for the successful deletion of a 1483 PVC: delete <pvc id>. The id is available at the configuration:atm:pvc:1483\$ show level.

### 3.3.4.3 Rate Queue Configuration

Use the rate submenu to configure up to eight rate queues that can be applied to PVCs that support RFC 1483, bridging network interconnect traffic over the ATM AAL5 layer.

**NOTE:** When assigning a given Rate Queue1, say 15 Mbps, to multiple PVCs, the user **SHOULD** be aware that the 15 Mbps rate will be shared equally by the PVCs. For example, if there are 5 PVCs assigned to the Rate Queue1, then each PVCs will entitled to use 3 Mbps.

**NOTE:** When deleting a rate queue, it is advisable that all PVCs associated with that rate queue be deleted before deleting the rate queue.

The user can reach this level by typing rate at the configuration:atm level. Then, by entering ? at the prompt, a list of available subcommands for the rate menu is displayed.

```
ES-3850::11.1.1.39:configuration:atm$ rate
ES-3850::11.1.1.39:configuration:atm:rate$ ?
show          new          peak          delete
up            top          exit          ?
```

The subcommands are defined as follows:

**Show** The show command allows the user to view all the currently configured rate queues.

**New** The new command allows the user to create a new rate queue with a peak bit rate. The following parameters are required for the successful creation of rate queue: new <2..155 mbps>.

- Peak** The peak command allows the user to change the definition of an existing rate queue. The following parameters are required for the successful alteration of a rate queue: peak <atm rate id> <2..155 mbps>. The rate queues should already be defined at the configuration:atm:rate level.
- Delete** The delete command allows the user to delete an existing rate queue. The following parameters are required for the successful deletion of a rate queue: delete <atm rate id>. The id is available at the configuration:atm:rate:\$ show level.

### 3.3.5 IP Parameter Configuration

Use the ip submenu to configure IP parameters on the ES-3850. The user can reach this level by typing ip at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for IP parameters is displayed.

```
ES-3850::host:configuration:ip:$
ES-3850::host:configuration:ip:$ ?
```

show	delete	new	address
net_mask	gateway	name	mngt_vinet
up	top	exit	?

The subcommands are defined as follows:

- Show** The show command allows the currently set values of the IP parameters to be displayed. Included are the IP address, subnet mask, default gateway, and management ViNet applicable to this ES-3850 unit.
- Delete** The delete command allows the user to delete an IP interface from a ViNet. The following parameters are required for the successful deletion of an IP interface: delete <vilan id>. The id is available at the configuration:vinet\$ show level.



<b>New</b>	The new command allows the user to configure a new IP interface for a ViNet on the ES-3850. The following parameters are required for the successful creation of an IP interface: new <vlan id> <ip address> <network mask>. The id is available at the configuration:vinet\$ show level.
<b>Address</b>	The address command allows the user to set the IP address for the ES-3850 unit. This IP address is used for all IP communications to the unit (telnet, TFTP, SNMP, etc.). Enter the desired IP address in standard dotted quad notation. This action takes place immediately upon command entry.
<b>Net_Mask</b>	The net_mask command allows the user to set the IP subnet mask for the ES-3850 unit. Enter the desired subnet mask in standard dotted quad notation. This action takes place immediately upon command entry.
<b>Gateway</b>	The gateway command allows the user to set an IP address of the default gateway (router) for each VLAN, if applicable. Enter the desired IP address in standard dotted quad notation. This action takes place immediately upon command entry. A maximum of 16 gateway addresses can be entered.



<b>Name</b>	The hostname command allows the user to set the hostname for the ES-3850 unit. This action takes place immediately upon command entry.
<b>Mngt_Vinet</b>	<p>The <code>mngt_vinet</code> command allows the user to configure which ViNet (Virtual Network) that this ES-3850 belongs. This allows (or controls) which ATM LAN Emulation Client systems that are running IP can access the ES-3850 console and SNMP subsystem. The following parameters are required for the successful association to a ViNet: <code>mngt_vinet &lt;vlan id&gt;</code>. The <code>id</code> is available at the configuration: <code>vinet\$ show level</code>.</p> <p>NOTE: As long the device is not configured for multiple IPs, you will always have the default management ViNet through which you may manage the device. Once you define more IPs (per VLAN), you may manage it via other VLANs, change boot parameters, etc.</p> <p>The management ViNet acts as a fail-safe IP that always exists, even if all other VLAN IPs are erased. The IP of the default (management) VLAN is the only one that can be configured via the boot parameters.</p> <p>This is not the case for the other VLANs. So if everything else failed, you may still use the serial port to configure the defaults.</p>

### 3.3.6 Displaying Basic Configuration Information

Use the show command to display the global configuration information for this ES-3850. Included in this display are: EPROM version, Operational Software version, XILINX versions ES-3850 MAC Address, Bridge Aging Time, LECS ATM Address, LES ATM Address , and ATM Operation Mode.

```
ES-3850::11.1.1.1.37:configuration$ show
EPROM version      : $Id: bootConfig.c,v 1.24 1995/10/22 14:38:23
baruch Exp $
Created on         : Sun Oct 22 16:41:16 IST 1995
Software version   : Hy.4p
Created on         : Wed Dec 18 18:18:57 IDT 1996
XILINX BP4 version : Tue May 21 15:16:03 IDT 1996
XILINX QLAN version : Sun Jul 14 17:04:20 IDT 1996
Kernel version     : WIND version 2.4
VxWorks version    : 5.2
Own MAC Address     : 00:40:0d:50:01:08
Bridge Aging Time   : 300000 seconds
LECS ATM Address    :
47:00:79:00:00:00:00:00:00:00:00:00:00:a0:3e:00:00:01:0
0
LES ATM Address     :
47:00:05:80:ff:e1:00:00:00:f2:1a:1d:a7:00:20:48:1a:1d:a7:1
5
ATM LANE            : ATM Forum
OC3 Ports           : 1
OC3 LineType        : Unknown
```

### 3.3.7 Software Download Configuration

Use the boot submenu to configure the parameters for downloading software to the ES-3850. The user can reach this level by typing boot at the configuration level. Then, by entering ? at the prompt, a list of available subcommands for the boot parameters is displayed.

```
ES-3850::host:configuration:boot:$  
ES-3850::host:configuration:boot:$ ?
```

```
server>          username          password          protocol  
filename         from          load          port  
show            up          top          exit  
?
```

The subcommands are defined as follows:

- Server** This submenu allows the user to configure the boot server parameters on the ES-3850. The user can reach this level by typing server at the configuration:boot level. Then, by entering ? at the prompt, a list of available subcommands for server submenu is displayed.
- Username** The username command is used to set the login username for the server containing the operational code for the ES-3850. This is the “username” that the ES-3850 will use to log in to the specified server for downloading new operational code. This action takes place immediately upon command entry. The username only has significance when using ftp mode.
- Password** The password command is used to set the login password for the server containing the operational code for the ES-3850. This is the “password” that the ES-3850 will use to log in to the specified server to download new operational code. This action takes place immediately upon command entry. The password option only has significance when using ftp mode.



<b>Load</b>	The load command is used to load the boot code into either RAM or Flash. The default is Flash, which is usually the preferred location to load the software.
<b>Protocol</b>	The protocol command is used to set the protocol that the ES-3850 will use to communicate to the server containing the operational code for the ES-3850. The choices are ftp, tftpc (TFTP client), or tftps (TFTP server). This action sets the protocol immediately upon command entry. The set protocol is used upon next reboot.
<b>Filename</b>	The filename command allows the user to specify the path and filename on the server host that the ES-3850 will download. Specify the path and filename where the upgrade code is on the server. This action takes place immediately upon command entry.
<b>From</b>	The from command allows the user to specify whether the ES-3850 will obtain its boot code from the on-board flash memory (normal operational mode) or from the network. The network boot mode is used to upgrade the ES-3850 operational code. This command takes effect upon reboot of the ES-3850.
<b>Port</b>	The port command allows the user to select the Ethernet port from which the ES-3850 will communicate to the boot server. The port command takes the numeric value of the Ethernet port as a parameter (1-16).

**NOTE:** The upgrade is not possible from the ATM port.

**Show** The show command allows the user to view the boot parameters that are set on the ES-3850. These include: Boot Method , Booting Ethernet Port , host name, IP address, user id, password, and filename.

3.3.7.1 Boot Server Parameter Configuration

Use the server submenu to configure the boot server parameters on the ES-3850. The user can reach this level by typing server at the configuration:boot level. Then, by entering ? at the prompt, a list of available subcommands for the boot server parameters is displayed.

```
ES-3850::host:configuration:boot:server:$
ES-3850::host:configuration:boot:server:$ ?
```

ip	name	up	top
exit	?		

The subcommands are defined as follows:

- IP** The IP command allows the user to set the IP address for the server containing the operational code for the ES-3850. This parameter is typically used only when upgrading the unit to a new software revision. Enter the desired IP address in standard dotted quad notation. This action takes place immediately upon command entry.
- Name** The name command allows the user to set the network name for the server containing the operational code for the ES-3850. This parameter is typically used only when upgrading the unit to a new software revision. This action takes place immediately upon command entry.

### 3.3.8 Monitor Port Configuration

Use the monitor submenu to configure the Ethernet port monitor parameters on the ES-3850. The user can reach this level by typing monitor at the configuration level. Then, by entering ? at the prompt, a list of available commands for the monitor port configuration is displayed.

```
ES-3850::host:configuration:monitor:$ ?
```

show	port	status	up
top	exit	?	

The subcommands are defined as follows:

- Port** The port command allows the user to specify which Ethernet port will be monitored by port 16, the master monitor port. In this way, a protocol analyzer or RMON device can “sniff” packets on one of the other 15 ports on the ES-3850. Note that for the port command to work, the ES-3850 must be configured to have global monitoring turned on. Additionally, port 16 is the only port that can be the “master” port on the ES-3850. This action takes place immediately upon command entry.
- Status** The status command allows the user to enable or disable monitoring globally on the ES-3850. If enabled, port 16 is a monitor port, and the port command can be used dynamically to monitor any given Ethernet port on the ES-3850 (via the device on port 16). Changing the status of monitoring requires a reboot of the ES-3850 to take effect.
- Show** The show command allows the user to view the current configuration for Ethernet port monitoring. This command shows the following parameters: Monitoring mode (enabled/disabled) and the port that will be monitored (1 through 15, inclusive).

### 3.3.9 Virtual Network Configuration and ELAN Association

Use the `vinet` submenu to configure virtual networks (ViNets) and to associate ELANs to ViNets on the ES-3850. The user can reach this level by typing `vinet` at the configuration level. Then, by entering `?` at the prompt, a list of available commands for the `vinet` menu is displayed.

```
ES-3850::host:configuration:vinet:$
ES-3850::host:configuration:vinet:$ ?
failover>          show          new          ports
stp>               delete        up          top
exit               ?
```

The subcommands are defined as follows:

- Failover**    The failover submenu allows the user to display the existing ELANs and the available failover information.
- Show**        The show command allows the user to view the current configuration for the ViNet parameters. This command shows the following parameters: ViNet, status, associated ELAN, ports.
- New**         The new command allows the user to configure a new ViNet on the ES-3850 and associate this ViNet to an ATM ELAN. The ViNet will allow mappings of one or more Ethernet port to an ATM emulated Ethernet LAN. By default, all Ethernet ports are mapped to the ViNet id 0, which is mapped to the “default” ELAN. Use the new command to create failover ELANs.

**NOTE:**    For a new ViNet to be made active and available, the ES-3850 must be rebooted.

- Ports**        The ports command allows the user to specify which Ethernet ports on the ES-3850 get mapped into which ViNet. As long as the ViNet and ELAN are defined and active, Ethernet ports may be added into that ViNet. Note that any given Ethernet port may be in only one ViNet.



- STP** This submenu allows the user to configure the Spanning Tree Protocol parameters for each ViNet on the ES-3850.
- Delete** The delete command allows the user to delete a ViNet. Ethernet ports that are in a ViNet that is deleted are returned to the “generic” (default) ViNet upon ES-3850 reboot. This parameter will take effect upon a reboot of the ES-3850.

### 3.3.9.1 Failover Configuration for ViNets

Failover ELANs are configured at the configuration:vinet level. To configure a failover instance, enter the following command: new <vilan id> <elan name>. For example, to set up a failover instance, enter new 1 default | 1. The show command would display the following:

#### VINETs Configuration

ViNet	Status	Associated Elan	Ports ...
0	Ready	default	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1	Ready	default	1

Use the failover submenu to show all the existing ELANs and failover information. The user can reach this level by typing failover at the configuration:vinet level. Then, by entering ? at the prompt, a list of available commands for the stp menu is displayed.

```
ES-3850::11.1.1.39:configuration:vinet$ fail
ES-3850::11.1.1.39:configuration:vinet:failover$ ?
show          delete          up          top
exit          ?
```

The subcommands are defined as follows:

- Show** The show command allows the user to view the current ELANs and the corresponding failover information.
- Delete** The delete command allows the user to delete an existing ELAN or failover assignment.



3.3.9.2 STP Parameter Configuration for ViNets

Use the stp submenu to configure the Spanning Tree Protocol parameters for each ViNet on the ES-3850. The user can reach this level by typing stp at the configuration:vinet level. Then, by entering ? at the prompt, a list of available commands for the stp menu is displayed.

**NOTE:** These parameters are defined per bridge group which constitutes the ELAN and the ViNet. These parameters override any parameters configured per port or per ELAN.

```
ES-3850::host:configuration:vinet:stp:$
ES-3850::host:configuration:vinet:stp:$ ?
```

priority	hello_time	max_aging_time	forward_delay
show	up	top	exit
?			

The subcommands are defined as follows:

**Priority** The priority command allows the Spanning Tree Protocol priority to be set for any ViNet on the ES-3850. The range of allowed values is 0-65535, with a default of 32768. This action takes place immediately upon command entry.

WARNING: The priority command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

**Hello\_time** The hello\_time command allows the Spanning Tree Protocol hello time to be set for any ViNet on the ES-3850. The range of allowed values is 0-65535, with a default of 200. This action takes place immediately upon command entry.



WARNING: The hello time command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

**Max\_aging\_time**

The max\_aging\_time command allows the Spanning Tree Protocol maximum aging time to be set for any ViNet on the ES-3850. The range of allowed values is 0-65535, with a default of 2000. This action takes place immediately upon command entry.

WARNING: The max\_aging\_time command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

**Forward\_delay**

The forward\_delay command allows the Spanning Tree Protocol forward delay time to be set for any ViNet on the ES-3850. The range of allowed values is 0-65535, with a default of 1500. This action takes place immediately upon command entry.

WARNING: The forward\_delay command is for advanced users only. Changing this value without careful consideration and knowledge of the Spanning Tree Protocol can adversely affect the operation of your network. Most users will find the default value to be acceptable in all applications. Please refer to the IEEE 802.1d Spanning Tree Protocol specification for additional information.

**Show**

The show command allows the user to view the current configuration for the ViNet Spanning Tree protocol. This command shows the following parameters: vinet, priority, hello time, max age, forward delay

### 3.3.10 LECS Address Configuration

The LECS command allows the user to specify the 20 byte ATM NSAP address of the LAN Emulation Configuration Server. The NSAP address is specified in hexadecimal, using a colon (:) as a delimiter between bytes. The default value is the ATM Forum standard "Well-Known LECS Address" (47:00:79:00:00:00:00:00:00:00:00:00:00:00:00:00:a0:3e:00:00:01:00 ).

**NOTE:** If you use this command to manually configure the LECS address, then the LEC will not discover the LECS at the well known address or over the 0,17 PVC. Furthermore, the only method of connecting with an LECS is to use this manually configured address, as no other discovery method will be used.

### 3.3.11 LES Address Configuration

The LES command allows the user to specify the 20 byte ATM NSAP address of the LAN Emulation Server. The NSAP address is specified in hexadecimal, using a colon (:) as a delimiter between bytes. This parameter allows the user to join an ELAN in a network that is not running a LECS

### 3.3.12 Aging\_time Configuration for FDB and LEARP

The aging\_time command allows the user to specify the aging time-out for bridge table entries. The default value is 300 seconds.

**WARNING!** The aging\_time command is for advanced users only. Changing this value without careful consideration and knowledge of the 802.1d bridge operation could adversely affect your network. Most users will find the default value to be acceptable in all applications.

## 3.4 Statistics and Operation Information

---

This section contains information on the statistics commands that are available from the ES-3850 user interface. The main statistics menu can be found at the root level of the menu tree. There are multiple commands available under the statistics menu. Typing ? at the prompt at the statistics level displays the available commands as follows:

```
ES-3850::host:statistics$ ?
```

```
sysuptime      interfaces    ethernet     sonet
atm             fdb          stp           learp
lec            up           top           exit
?
```

The subcommands are defined as follows:

- |                   |  |
|-------------------|--|
| <b>Sysuptime</b>  | The sysuptime command allows the user to see the amount of time that the ES-3850 has been up and running since the last reboot.  |
| <b>Interfaces</b> | The interfaces command allows the user to view interface statistics in formatted, summarized table format. The interfaces statistics include: Interfaces Characteristics (port number, description, type, speed, admin status, operational status), tx and rx data, discarded cells/frames, etc. |
| <b>Ethernet</b>   | The ethernet command allows the user to view Ethernet port transmit and receive statistics. This command shows Ethernet statistics such as : tx and rx collision counts, carrier loss, fcs errors, alignment errors, and jabbers in a table format.  |
| <b>Sonet</b>      | The sonet command allows the user to view the sonet statistics of the ATM OC-3 port. The command shows sonet statistics such as : line coding, line type, errored seconds (section and line), coding violations (section and line), unavailable seconds, far end status, etc.                    |

- ATM** The ATM command allows the user to view general ATM statistics of the ES-3850. This command shows statistics such as: max, VP's, max VC's, configured VP's, configured VC's, ILMI VPI, VCI, HEC errors, VCI statistics, signaling statistics, AAL5 statistics, etc.
- FDB** The fdb command allows the user to view the bridge table for a given ViNet (specified by the ViNet index number). The information is presented in table format, with port and MAC address information.
- STP** The stp command allows the user to view a table of the state of Spanning Tree Protocol on a per- port basis.
- LEARP** The learp command allows the user to view the ATM LAN Emulation ARP table. The information is presented in table format, with MAC and NSAP address information.
- LEC** The lec command shows the state and the ATM addresses of the LEC and the LES for a specific ELAN.

### 3.4.1 Viewing Interface Characteristics and Counters

This section contains information on the interfaces command that is available from the main statistics menu. The interfaces command allows the user to view interface statistics in formatted, summarized table format. These statistics tables include the Interfaces Characteristics table (port number, description, type, speed, admin status, operational status), and the Interfaces Counters tables (tx and rx data, discarded cells/frames, etc.).

**NOTE:** Press the space bar or the return key to scroll through the Interfaces Characteristics table to reach the Interfaces Counters table. Press Q to exit to the shell.

#### Interfaces Characteristics

Port	Desc	Name	Speed	Admin	Oper
1	Ethernet	Eth1	10	up	up
2	Ethernet	Eth2	10	up	up
3	Ethernet	Eth3	10	up	up
4	Ethernet	Eth4	10	up	up
5	Ethernet	Eth5	10	up	down
6	Ethernet	Eth6	10	up	down
7	Ethernet	Eth7	10	up	down
8	Ethernet	Eth8	10	up	down
9	Ethernet	Eth9	10	up	up
10	Ethernet	Eth10	10	up	up
11	Ethernet	Eth11	10	up	up
12	Ethernet	Eth12	10	up	down
13	Ethernet	Eth13	10	up	down
14	Ethernet	Eth14	10	up	down
15	Ethernet	Eth15	10	up	down
16	Ethernet	Eth16	10	up	down

PRESS SPACE , RETURN OR Q.

The table items are defined as follows:

<b>Port</b>	Indicates the port number.
<b>Desc</b>	Describes the type of the port.
<b>Name</b>	The assigned name for the given interface.
<b>Speed</b>	The speed of the interface in megabits per second.
<b>Admin</b>	The administrative status (state) of the port as configured through the user interface, either up or down.
<b>Oper</b>	The actual operational status (state) of the port (up or down).

Interfaces Counters

Port	InPkt	InEr	InDisc	OutPkt	OutEr	OutDisc
1	8162	0	0	87345	0	0
2	14598	0	0	94271	0	0
3	13008	0	0	93211	0	0
4	15726	0	0	90110	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	1	0	0
9	45298	0	0	135204	0	0
10	3588	0	0	87069	0	0
11	112835	0	0	202139	0	0
12	30662	0	0	100050	0	0
13	0	0	0	0	0	0
14	0	0	0	0	0	0
15	0	0	0	0	0	0
16	0	0	0	0	0	0

PRESS SPACE , RETURN OR Q.



The table items are defined as follows:

<b>Port</b>	Indicates the port number.
<b>InPkt</b>	Input packets. The total number of valid packets received at this port that have been processed.
<b>InEr</b>	Input errors. The total number of errored packets received at this port.
<b>InDisc</b>	Input discards. The total number of valid packets received at this port that have not been processed (i.e. discarded). This would occur mostly due to memory overflow under heavy traffic conditions.
<b>OutPkt</b>	Output packets. The total number of successfully transmitted packets at this port.
<b>OutEr</b>	Output errors. The total number of valid packets at this port that have experienced a transmission error (such as late collision, excessive collision, etc.).
<b>OutDisc</b>	Output discards. The total number of valid packets that should have been transmitted out of this port, but have been discarded. This would occur mostly due to memory overflow under heavy traffic conditions.



### 3.4.2 Viewing Ethernet Characteristics

This section contains information on the ethernet command that is available from the main statistics menu. The ethernet command allows the user to view Ethernet port transmit and receive statistics, as well as transmit and receive collision counts, carrier loss, FCS errors, alignment errors, and jabbers in a table format.

**NOTE:** Press the space bar or the return key to scroll through the Ethernet Ports statistics tables. Press Q to exit to the shell.

Ethernet Ports statistics

-----

Transmit Info Counters

-----

Port	Single Col	Multiple Col	Deferred Trn
1	1	0	9
2	66	68	159
3	11	18	36
4	23	20	46
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	17	14	204
10	0	0	0
11	11	16	374
12	27	32	52
13	0	0	0
14	0	0	0
15	0	0	0
16	0	0	0

PRESS SPACE , RETURN OR Q.

The table items are defined as follows:

<b>Port</b>	Indicates the port number.
<b>Single Col</b>	Single collisions. The ethernet port attempted to transmit, detected a collision, backed off, then retransmitted successfully.
<b>Multiple Col</b>	Multiple collisions. The ethernet port attempted to transmit, detected a collision, backed off, detected N more collisions (where $N < 15$ ), then retransmitted successfully.
<b>Deferred Trn</b>	Deferred transmissions. The number of frames that were transmitted successfully after at least one collision.

#### Transmit Error Counters

Port	Late Col	Excessive Col	MAC Internal	Carrier Loss
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0

The table items are defined as follows:

<b>Port</b>	Indicates the port number.
<b>Late Col</b>	Late collisions. The total number of late collision events (a collision condition that occurred after one time slot - 512 bit times - after the transmit process was initiated).
<b>Excessive Col</b>	Excessive collisions. The total number of excessive collision events (16 consecutive attempts to transmit a frame had failed due to repeated collision on the medium). This will cause to discard this packet.
<b>MAC Internal:</b>	The total number of transmission failure events due to internal system error (such as fifo underflow, frame too long, etc.)
<b>Carrier Loss</b>	Total number of carrier loss events (no heart bit signal has been detected)

Receive Error Counters

Port	Alignment	FCS (CRC)	MAC Internal	Frame Long
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	0	0	0	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	0	0	0	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0

PRESS SPACE , RETURN OR Q.



The table items are defined as follows:

<b>Port</b>	Indicates the port number.
<b>Alignment</b>	Total number of received packets with an alignment error (received frame length is not a multiple of 8 bits, and an FCS error had occurred).
<b>FCS (CRC)</b>	Total number of received packets with a Frame Check Sequence (FCS) or a Cyclic Redundancy Check (CRC) error.
<b>MAC Internal</b>	Total number of received packets which have experience an error due to internal system error (such as fifo overflow etc.).
<b>Frame Long</b>	Total number of received frames with an illegal packet length (>1518 bytes).

### 3.4.3 Viewing ATM Characteristics

This section contains information on the atm command that is available from the main statistics menu. The atm command allows the user to view general ATM statistics of the ES-3850. This command shows statistics such as: max, VP's, max VC's, configured VP's, configured VC's, ILMI VPI, VCI, HEC errors, VCI statistics, signaling statistics, AAL5 statistics, etc.

**NOTE:** Press the space bar or the return key to scroll through the ATM statistics tables. Press Q to exit to the shell.

ATM Configuration Parameters

-----	
Index	19
Max vccs	1024
Configured vccs	3
Ilmi vpi	0
Ilmi vci	16

ATM TC\_SUBLAYER

-----		
Index	Alarm state	HEC Errors
19	normal	2

ATM VCLs

-----				
Index	Vpi	Vci	Oper Status	Admin Status
19.	0	16	up	up
19.	0	5	up	up
19.	0	35	up	up
19.	0	38	up	up
19.	0	40	up	up
19.	0	42	up	up
19.	0	171	up	up
19.	0	69	up	up
19.	0	70	up	up
19.	0	71	up	up
19.	0	73	up	up
19.	0	128	up	up

AAL5 VCCs

-----

Index	Vpi	Vci	CrcErrors	SarTimeouts	OverSizedSdus
20.	0	16	0	0	0
20.	0	5	0	0	0
20.	0	35	0	0	0
20.	0	38	0	0	0
20.	0	40	0	0	0
20.	0	42	0	0	0
20.	0	171	0	0	0
20.	0	69	0	0	0
20.	0	70	0	0	0
20.	0	71	0	0	0
20.	0	73	0	0	0
20.	0	128	0	0	0

The table items are defined as follows:

<b>Index</b>	This is the port number for the ATM port.
<b>Max vccs</b>	This is the maximum number of VCCs that are supported by the unit.
<b>Configured vccs</b>	This is the number of VCs that are currently active.
<b>Ilmi vpi and Ilmi vci</b>	These values signify the VPI and VCI that are used to send the ILMI messages to the attached ATM switch.

### 3.4.4 Viewing LEC Characteristics

This section contains information on the `lec` command that is available from the main statistics menu. The `lec` command allows the user to view the state and the ATM addresses of the LEC and the LES for a specific ELAN.

**NOTE:** Press the space bar or the return key to scroll through the LEC tables. Press Q to exit to the shell.

```
LECs statistics
-----
Index          Name          ATM Addresses
  1  default LEC : 47.0005.80.ffe100.0000.f21a.0127.00400d500111.00
      LES      : 47.0005.80.ffe100.0000.f21a.0127.00204806136f.10
      STATE   : Operational
```

The table items are defined as follows:

- Index**    The number of the ELAN that the following fields correspond to.
- Name**    This is the name of the ELAN
- LEC**      This is the ATM address the LEC (this ES3850) has used to register itself with the LES after joining the ELAN.
- LES**      This is the ATM address of the LES (LAN Emulation Server) that the LEC used to join the ELAN with name defined in the “Name” field.
- STATE**    This field determines the state of the ELAN. All ELANs must have this field as “Operational” after a successful join. If the state is different then this means the LEC is no more part of this ELAN.



### 3.4.5 Viewing FDB Characteristics

This section contains information on the fdb command that is available from the main statistics menu. The fdb command allows the user to view the bridge table for a given ViNet (specified by the ViNet index number). The information is presented in table format, with port and MAC address information.

**NOTE:** Press the space bar or the return key to scroll through the FDB table. Press Q to exit to the shell.

Following is the output from the “statistics->fdb” command on the vinet 0 :

Entry	ViNet	Address	Port	Status	VCC
1	0	00 40 0d 50 01 11	0	self	0:110
1	0	08 00 20 12 d8 fc	17	learned	0:111
1	0	08 00 20 12 c1 fe	17	learned	0:120
1	0	00 20 48 06 13 6f	17	learned	n/a
1	0	00 40 0d 50 01 08	0	self	n/a



The table items are defined as follows:

<b>Entry</b>	Indicates the entry number in this table.
<b>ViNet</b>	This is the number of the “ViNet” associated with the addresses in the table.
<b>Address</b>	This is the MAC address of a station.
<b>Port</b>	This is the port number on which we saw frames originated from a station which has the same MAC address as in “Address” field. The ATM port is assigned a port number of 17.
<b>Status</b>	This field tells the status of the field. There are only two possible values for this field, self and learned. Self means that the address belongs to the unit itself. Learned means that the unit learned these addresses by observing the frames on different ports.
<b>VCC</b>	This field is relevant only for addresses that are learned on the ATM port. This field tells the user if there is a “Data Direct VCC” that is associated with this table entry. N/A indicates that the address is not learned on the ATM port.

### 3.4.6 Viewing STP Characteristics

This section contains information on the stp command that is available from the main statistics menu. The stp command allows the user to view a table of the state of Spanning Tree Protocol on a per-port basis.

**NOTE:** Press the space bar or the return key to scroll through the STP table. Press Q to exit to the shell.

#### Bridge STP State

-----

Port	ViNet	ELAN	STP State
1	0	default	Disabled
2	0	default	Disabled
3	0	default	Disabled
4	0	default	Disabled
5	0	default	Disabled
6	0	default	Disabled
7	0	default	Disabled
8	0	default	Disabled
9	0	default	Disabled
10	0	default	Disabled
11	0	default	Disabled
12	0	default	Disabled
13	0	default	Disabled
14	0	default	Disabled
15	0	default	Disabled
16	0	default	Disabled
17	0	default	Disabled

The table items are defined as follows:

<b>Port</b>	The port number for which the following information fields pertain to.
<b>ViNet</b>	The Virtual network number that this port is assigned to.
<b>ELAN</b>	The name of the ELAN this port is associated with.
<b>STP State</b>	<p>The state of the “STP” on this particular port. Valid states are:</p> <p>Disabled - either STP on this port is disabled or the port is not connected.</p> <p>Listening - this port has STP enabled and the port is connected and the unit is listening for STP frames from the other end.</p> <p>Learning- this port has received STP frames and is in the process of determining the “root” bridge on this port by processing these STP frames.</p> <p>Forwarding - this port is determined to be the “root” of the Spanning tree and is therefore forwarding the frames on this port.</p> <p>Blocking - this port is determined to be a redundant port which would cause a loop in the network and is therefore blocking all the frames from going out on this port.</p> <p>NOTE: Whenever the STP mode is changed, the bridge re-enters the listening-&gt;learning (then forwarding) sequence, which takes 40 seconds during which you have no forwarding of data over all ports.</p>

### 3.4.7 Viewing LEARP Characteristics

This section contains information on the learp command that is available from the main statistics menu. The learp command allows the user to view the ATM LAN Emulation ARP table. The information is presented in table format, with MAC and NSAP address information.

**NOTE:** Press the space bar or the return key to scroll through the LEARP table. Press Q to exit to the shell.

Le ARP Table

-----

MAC Address	ATM Address
00 20 48 06 13 6f	47000580ffe1000000f21a012700204806136f01

The table items are defined as follows:

<b>MAC Address</b>	The MAC address of a LEC on the ATM port.
<b>ATM Address</b>	The destination ATM address that the above MAC address was resolved to using the LEARP_REQUEST.

### 3.5 Miscellaneous Operations

This section contains information on the operation commands that are available from the ES-3850 user interface. The main operation menu can be found at the root level of the menu tree. Typing ? at the prompt at the operation level displays the commands as follows:

```
ES-3850::host:operation$ ?

password>      init_defaults  rows      timeout
reboot         up             top       exit
?
```

The subcommands are defined as follows:

- Password** This submenu allows the user to configure the password parameters on the ES-3850.
- Init\_defaults** The init\_defaults command allows the administrative user to re-initialize the ES-3850 configuration NVRAM to factory defaults. This option must be confirmed.  
  
NOTE: This command does not reset any of the boot parameters shown on page 2-8.
- Rows** This command allows the user (administrators or user level) to set the number of rows for the attached display for the current session. The default is 24. This action takes place immediately upon command entry.
- Timeout** This command allows you to set the session timeout value when a user is logged in with “administrative” or “user” privileges. At the end of the time specified as an argument to this command the session will be closed by logging the user out. The argument to this command is “timeout in minutes”.
- Reboot** This command allows the administrator level user to reboot the ES-3850. This option must be confirmed.



### 3.5.1 Password Configuration

Use the password submenu to change the passwords on the ES-3850. The user can reach this level by typing password at the operation level. Then, by entering ? at the prompt, a list of available commands for the password menu is displayed.

```
ES-3850::host:operation:password:$
```

```
ES-3850::host:operation:password:$ ?
```

supervisor	user	up	top
exit	?		

The subcommands are defined as follows:

**Supervisor** The supervisor command allows the administrator user to select a new supervisor level password for the ES-3850. The current password must be entered, and the new password is confirmed by a second entry. The password may be from 8-40 characters. This action takes place immediately upon command entry.

**User** The user command allows the administrator user to select a new user level password for the ES-3850. The current password must be entered, and the new password is confirmed by a second entry. The password may be from 8-40 characters. This action takes place immediately upon command entry.

# APPENDIX A

## Alternate Software Upgrade Procedure

In the future, software upgrades may be released for the ES-3850. Software can be downloaded to the ES-3850 unit over the Ethernet using an ASCII terminal as follows:

1. Disconnect the power cord.
2. Connect a terminal to the ES-3850 unit and configure the terminal: 9600 baud, 8 data bits, 1 stop bit, no parity, xon/xoff flow control.
3. Reconnect the power cord.
4. After the self-tests, a countdown will appear on the terminal screen. Press any key to stop the countdown.
5. At the prompt, type **p** and press <Enter> to view the basic configuration parameters with their current values, or type **c** and press <Enter> to change the values.
6. Set the parameters as follows:

<b>Server Name</b>	Host name of the server from which new software will be downloaded.
<b>Server IP Address</b>	IP address of the server from which new software will be downloaded.
<b>Gateway IP Address</b>	If the server from which new software will be downloaded is accessed via a Gateway (router), type in the IP address of the Gateway.
<b>Boot File Name</b>	Path and name of the new software file to be downloaded.
<b>User Name</b>	The user name used to log on to the server from which new software will be downloaded.
<b>User Password</b>	The password used to log on to the server from which new software will be downloaded.
<b>Boot Device</b>	Set this parameter to <b>N</b> (for Network) so new software will be taken from the network instead of existing software.

<b>Boot Port</b>	Select one of the Ethernet ports (numbered 1 to 16) via which the downloading will take place.  NOTE: It is not possible to use the ATM port for software upgrades.
<b>Protocol</b>	Which protocol will be used for downloading new software: F for FTP, T for TFTP.
<b>TFTP Mode</b>	When using TFTP for downloading new software, set this parameter to C for Client or S for Server. Set to Client to download automatically from the server host running TFTP services.  Setting the parameter to Server requires you to start a TFTP session at the workstation containing the boot file and use the put command to initiate download.
<b>Load Into</b>	This parameter should be set to F for Flash.

**NOTE:** Press Enter to change the values. Type @ at the boot prompt to start the software download process.



# GLOSSARY

**802.1d Spanning Tree Bridging** - the IEEE standard for bridging; a MAC layer standard for transparently connecting two or more LANs (often called subnetworks) that are running the same protocols and cabling. This arrangement creates an extended network, in which any two workstations on the linked LANs can share data.

**802.3 Ethernet** - the IEEE standard for Ethernet; a physical-layer standard that uses the CSMA/CD access method on a bus-topology LAN.

**802.5 Token Ring** - the IEEE physical-layer standard that uses the token-passing access method on a ring-topology LAN.

**AAL (ATM Adaptation Layer)** - the AAL divides the user information into segments suitable for packaging into a series of ATM cells. There are several types of AALs in use. FORE Systems currently supports AAL 5 and AAL 3/4. AAL 3/4 supports connection-oriented VBR data transfer and connectionless VBR data transfer, respectively. AAL 5 is defined as Simple and Efficient Adaptation Layer (SEAL).

**AAL Connection** - an association established by the AAL between two or more next higher layer entities.

**ABR (Available Bit Rate)** - a type of traffic for which the ATM network attempts to meet that traffic's bandwidth requirements. It does not guarantee a specific amount of bandwidth and the end station must retransmit any information that did not reach the far end.

**Address Mask** - a bit mask used to identify which bits in an address (usually an IP address) are network significant, subnet significant, and host significant portions of the complete address. This mask is also known as the subnet mask because the subnetwork portion of the address can be determined by comparing the binary version of the mask to an IP address in that subnet. The mask holds the same number of bits as the protocol address it references.

**Agent (SNMP)** - a component of network- and desktop-management software, such as SNMP, that gathers information from MIBs.

**AIS (Alarm Indication Signal)** - a line AIS is asserted when a 111 binary pattern is detected in bits 6, 7, 8 of the K2 byte for five consecutive frames. A line AIS is removed when any pattern other than 111 is detected in these bits for five consecutive frames.

**AMI (ATM Management Interface)** - the user interface to FORE Systems' *ForeThought* switch control software (SCS). AMI lets users monitor and change various operating configurations of FORE Systems switches and network module hardware and software, IP connectivity, and SNMP network management.

**ANSI (American National Standards Institute)** - a private organization that coordinates the setting and approval of some U.S. standards. It also represents the United States to the International Standards Organization.

**API (Application Program Interface)** - a language format that defines how a program can be made to interact with another program, service, or other software; it allows users to develop custom interfaces with FORE products.

**APP (application program)** - a complete, self-contained program that performs a specific function directly for the user.

**AppleTalk** - a networking protocol developed by Apple Computer for communication between Apple's products and other computers. Independent of the network layer, AppleTalk runs on LocalTalk, EtherTalk and TokenTalk.

**ARP (Address Resolution Protocol)** - a method used to resolve higher level protocol addressing (such as IP) into the appropriate header data required for ATM; i.e., port, VPI, and VCI; also defines the AAL type to be used.

**ASCII (American Standard Code for Information Interchange)** - a standard character set that (typically) assigns a 7-bit sequence to each letter, number, and selected control characters.

**Assigned Cell** - a cell that provides a service to an upper layer entity or ATM Layer Management entity (ATMM-entity).

**asxmon** - a FORE program that repeatedly displays the state of the switch and of all its active ports.

**Asynchronous time division multiplexing** - a multiplexing technique in which a transmission capability is organized into a priori, unassigned time slots. The time slots are assigned to cells upon request of each application's instantaneous real need.

**ATM (Asynchronous Transfer Mode)** - a transfer mode in which the information is organized into cells. It is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

**ATM Forum** - an international non-profit organization formed with the objective of accelerating the use of ATM products and services through a rapid convergence of interoperability specifications. In addition, the Forum promotes industry cooperation and awareness.

**ATM Layer link** - a section of an ATM Layer connection between two adjacent active ATM Layer entities (ATM-entities).

**ATM Link** - a virtual path link (VPL) or a virtual channel link (VCL).

**ATM Peer-to-Peer Connection** - a virtual channel connection (VCC) or a virtual path connection (VPC) directly established, such as workstation-to-workstation. This setup is not commonly used in networks.

**ATM Traffic Descriptor** - a generic list of parameters that can be used to capture the intrinsic traffic characteristics of a requested ATM connection.

**ATM User-to-User Connection** - an association established by the ATM Layer to support communication between two or more ATM service users (i.e., between two or more next higher layer entities or between two or more ATM entities). The communication over an ATM Layer connection may be either bidirectional or unidirectional. The same Virtual Channel Identifier (VCI) is used for both directions of a connection at an interface.

**atmarp** - a FORE program that shows and manipulates ATM ARP entries maintained by the given device driver. This is also used to establish PVC connections.

**atmconfig** - a FORE program used to enable or disable SPANS signalling.

**atmstat** - a FORE program that shows statistics gathered about a given adapter card by the device driver. These statistics include ATM layer and ATM adaptation layer cell and error counts. This can also be used to query other hosts via SNMP.

**Backbone** - the main connectivity device of a distributed system. All systems that have connectivity to the backbone connect to each other. This does not stop systems from setting up private arrangements with each other to bypass the backbone for cost, performance, or security.

**Bandwidth** - usually identifies the capacity or amount of data that can be sent through a given circuit; may be user-specified in a PVC.

**BGP (Border Gateway) Protocol** - used by gateways in an internet, connecting autonomous networks. It is derived from experiences learned using the EGP.

**BIP (Bit Interleaved Parity)** - an error-detection technique in which character bit patterns are forced into parity, so that the total number of one bits is always odd or always even. This is accomplished by the addition of a one or zero bit to each byte, as the byte is transmitted; at the other end of the transmission, the receiving device verifies the parity (odd or even) and the accuracy of the transmission.

**B-ISDN (Broadband Integrated Services Digital Network)** - a common digital network suitable for voice, video, and high-speed data services running at rates beginning at 155 Mbps.

**Bridge** - a device that expands a Local Area Network by forwarding frames between data link layers associated with two separate cables, usually carrying a common protocol. Bridges can usually be made to filter certain packets (to forward only certain traffic).

**Broadband** - a service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

**Broadband Access** - an ISDN access capable of supporting one or more broadband services.

**Router (bridging/router)** - a device that routes some protocols and bridges others based on configuration information.

**BUS (Broadcast and Unknown Server)** - in an emulated LAN, the BUS is responsible for accepting broadcast, multicast, and unknown unicast packets from the LECs to the broadcast MAC address (FFFFFFFFFFFF) via dedicated point-to-point connections, and forwarding the packets to all of the members of the ELAN using a single point-to-multipoint connection.

**CAC (Connection Admission Control)** - the procedure used to decide if a request for an ATM connection can be accepted based on the attributes of both the requested connection and the existing connections.

**Call** - an association between two or more users or between a user and a network entity that is established by the use of network capabilities. This association may have zero or more connections.

**CBR (Constant Bit Rate)** - a type of traffic that requires a continuous, specific amount of bandwidth over the ATM network (e.g., digital information such as video and digitized voice).

**cchan** - a FORE program used to manage virtual channels on a FORE Systems ATM switch running asxd.

**CCITT (International Telephone and Telegraph Consultative Committee)** - the international standards body for telecommunications.

**CDV (Cell Delay Variation)** - a quantification of cell clumping for a connection. The cell clumping CDV ( $y_k$ ) is defined as the difference between a cell's expected reference arrival time ( $c_k$ ) and its actual arrival time ( $a_k$ ). The expected reference arrival time ( $c_k$ ) of cell  $k$  of a specific connection is  $\max [c_{\{k-1\}} + T, a_k]$ .  $T$  is the reciprocal of the negotiated peak cell rate.

**CE (Connection Endpoint)** - a terminator at one end of a layer connection within a SAP.

**CEI (Connection Endpoint Identifier)** - an identifier of a CE that can be used to identify the connection at a SAP.

**Cell** - an ATM Layer protocol data unit (PDU).

**Cell Header** - ATM Layer protocol control information.

**Cell Transfer Delay** - the transit delay of an ATM cell successfully passed between two designated boundaries.

**CLP (Cell Loss Priority)** - the last bit of byte four in an ATM cell header; indicates the eligibility of the cell for discard by the network under congested conditions. If the bit is set to 1, the cell may be discarded by the network depending on traffic conditions.

**Concentrator** - a communications device that offers the ability to concentrate many lower-speed channels into and out of one or more high-speed channels.

**Connection** - the concatenation of ATM Layer links in order to provide an end-to-end information transfer capability to access points.

**Connectionless Service** - a type of service in which no pre-determined path or link has been established for transfer of information, supported by AAL 4.

**Connection-Oriented Service** - a type of service in which information always traverses the same pre-established path or link between two points, supported by AAL 3.

**Corresponding Entities** - peer entities with a lower layer connection among them.

**cpath** - a FORE program used to manage virtual paths on a FORE Systems ATM switch running asxd.

**cport** - a FORE program used to monitor and change the state of ports on a FORE Systems ATM switch running asxd.

**CRC (Cyclic Redundancy Check)** - an error detection scheme in which a number is derived from the data that will be transmitted. By recalculating the CRC at the remote end and comparing it to the value originally transmitted, the receiving node can detect errors.

**CS (Convergence Sublayer)** - a portion of the AAL. Data is passed first to the CS where it is divided into rational, fixed-length packets or PDUs (Protocol Data Units). For example, AAL 4 processes user data into blocks that are a maximum of 64 kbytes long.

**DARPA (Defense Advanced Research Projects Agency)** - the US government agency that funded the ARPANET.

**DCS (Digital Cross-connect System)** - an electronic patch panel used to route digital signals in a central office.

**Demultiplexing** - a function performed by a layer entity that identifies and separates SDUs from a single connection to more than one connection. (See multiplexing.)

**DIP Switch (Dual In-line Package)** - a device that has two parallel rows of contacts that let the user switch electrical current through a pair of those contacts to on or off. They are used to reconfigure components and peripherals.

**Domain Name Server** - a computer that converts names to their corresponding Internet numbers. It allows users to telnet or FTP to the name instead of the number.

**DNS (Domain Name System)** - the distributed name and address mechanism used in the Internet.

**DSn (Digital Standard n (0, 1, 1C, 2, and 3))** - a method that defines the rate and format of digital hierarchy.

Asynchronous data rates are defined as follows:

DS0	64kb/s	1 voice channel
DS1	1.544Mb/s	24 DS0s
DS1C	3.152 Mb/s	2 DS1s
DS2	6.312 Mb/s	4 DS1s
DS3	44.736 Mb/s	28 DS1s

Synchronous data rates (SONET) are defined as:

STS-1/OC-1	51.84 Mb/s	28 DS1s or 1 DS3
STS-3/OC-3	155.52 Mb/s	3 STS-1s byte interleaved
STS-3c/OC-3c	155.52 Mb/s	Concatenated, indivisible payload
STS-12/OC-12	622.08 Mb/s	12 STS-1s, 4 STS-3cs, or any mixture
STS-12c/OC-12c	622.08 Mb/s	Concatenated, indivisible payload
STS-48/OC-48	2488.32 Mb/s	48 STS-1s, 16 STS-3cs, or any mixture

**EGP (Exterior Gateway) Protocol** - used by gateways in an internet, connecting autonomous networks.

**EISA (Extended Industry Standard Architecture)** - a bus architecture for desktop computers that provides a 32-bit data passage while maintaining compatibility with the ISA or AT architecture.

**elarp** - a FORE program that shows and manipulates MAC and ATM address mappings for LAN Emulation Clients (LECs).

**elconfig** - a FORE program that shows and modifies LEC configuration. Allows the user to set the NSAP address of the LAN Emulation Configuration Server (LECS), display the list of Emulated LANs (ELANs) configured in the LECS for this host, display the list of ELANs locally configured along with the membership state of each, and locally administer ELAN membership.

**EPROM** - Erasable Programmable Read Only Memory (See PROM.)

**ES (End System)** - a system in which an ATM connection is terminated or initiated. An originating end system initiates the ATM connection, and a terminating end system terminates the ATM connection. OAM cells may be generated and received.

**Ethernet** - a 10-Mbps, coaxial standard for LANs in which all nodes connect to the cable where they contend for access.

**Fairness** - as related to Generic Flow Control (GFC), fairness is defined as meeting all of the agreed quality of service (QoS) requirements by controlling the order of service for all active connections.

**FCC** - a board of commissioners appointed by the President under the Communications Act of 1934, with the authority to regulate all interstate telecommunications originating in the United States, including transmission over phone lines.

**FDI (Fiber Distributed Data Interface)** - high-speed data network that uses fiber-optic as the physical medium. Operates in similar manner to Ethernet or Token Ring, only faster.

**FDM (Frequency Division Multiplexing)** - a method of dividing an available frequency range into parts with each having enough bandwidth to carry one channel.

**FEBC (Far End Block Error)** - an error detected by extracting the 4-bit FEBC field from the path status byte (G1). The legal range for the 4-bit field is between 0000 and 1000, representing zero to eight errors. Any other value is interpreted as zero errors.

**FERF (Far End Receive Failure)** - a line error asserted when a 110 binary pattern is detected in bits 6, 7, 8 of the K2 byte for five consecutive frames. A line FERG is removed when any pattern other than 110 is detected in these bits for five consecutive frames.

**FIFO (First-In, First-Out)** - a method of coordinating the sequential flow of data through a buffer.

**Flag** - a specific bit pattern used to identify the beginning or end of a frame.

**Frame** - a variable length group of data bits with a specific format containing flags at the beginning and end to provide demarcation.

**Frame Relay** - a fast packet switching protocol based on the LAPD protocol of ISDN that performs routing and transfer with less overhead processing than X.25.

**FT-PNNI (ForeThought PNNI)** - a FORE Systems pre-standard routing and signalling protocol that uses private ATM (NSAP) addresses; a precursor to ATM Forum PNNI (see PNNI).

**ftp (File Transfer Protocol)** - a TCP/IP protocol that lets a user on one computer access, and transfer data to and from, another computer over a network. ftp is usually the name of the program the user invokes to accomplish this task.

**GCRA (Generic Cell Rate Algorithm)** - an algorithm which is employed in traffic policing and is part of the user/network service contract. The GCRA is a scheduling algorithm which ensures that cells are marked as *conforming* when they arrive when expected or later than expected and *non-conforming* when they arrive sooner than expected.

**GFC (Generic Flow Control)** - the first four bits of the first byte in an ATM cell header. Used to control the flow of traffic across the User-to-Network Interface (UNI), and thus into the network. Exact mechanisms for flow control are still under investigation and no explicit definition for this field exists at this time. (This field is used only at the UNI; for NNI-NNI use (between network nodes), these four bits provide additional network address capacity, and are appended to the VPI field.)

**GIO** - a proprietary bus architecture used in certain Silicon Graphics, Inc. workstations.

**Header** - protocol control information located at the beginning of a protocol data unit.

**HEC (Header Error Control)** - a CRC code located in the last byte of an ATM cell header that is used for checking cell integrity only.

**HIPPI (High Performance Parallel Interface)** - an ANSI standard that extends the computer bus over fairly short distances at speeds of 800 and 1600 Mbps.

**HPUX** - the Hewlett-Packard version of UNIX.

**HSSI (High-Speed Serial Interface)** - a serial communications connection that operates at speeds of up to 1.544 Mbps.

**Hub** - a device that connects to several other devices, usually in a star topology.



**I/O Module** - FORE's interface cards for the LAX-20 LAN Access Switch, designed to connect Ethernet, Token Ring, and FDDI LANs to *ForeRunner* ATM networks.

**ICMP (Internet Control Message Protocol)** - the protocol that handles errors and control messages at the IP layer. ICMP is actually a part of the IP protocol layer. It can generate error messages, test packets, and informational messages related to IP.

**IEEE (Institute of Electrical and Electronics Engineers)** - the world's largest technical professional society. Based in the U.S.A., the IEEE sponsors technical conferences, symposia & local meetings worldwide, publishes nearly 25% of the world's technical papers in electrical, electronics & computer engineering, provides educational programs for its members, and promotes standardization.

**IETF (Internet Engineering Task Force)** - a large, open, international community of network designers, operators, vendors and researchers whose purpose is to coordinate the operation, management and evolution of the Internet to resolve short- and mid-range protocol and architectural issues.

**ILMI (Interim Local Management Interface)** - the standard that specifies the use of the Simple Network Management Protocol (SNMP) and an ATM management information base (MIB) to provide network status and configuration information.

**Interface Data** - the unit of information transferred to/from the upper layer in a single interaction across a SAP. Each Interface Data Unit (IDU) controls interface information and may also contain the whole or part of the SDU.

**internet** - while an internet is a network, the term "internet" is usually used to refer to a collection of networks interconnected with routers.

**Internet** - (note the capital "I") the largest internet in the world including large national backbone nets and many regional and local networks worldwide. The Internet uses the TCP/IP suite. Networks with only e-mail connectivity are not considered on the Internet.

**Internet Addresses** - the numbers used to identify hosts on an internet network. Internet host numbers are divided into two parts; the first is the network number and the second, or local, part is a host number on that particular network. There are also three classes of networks in the Internet, based on the number of hosts on a given network. Large networks are classified as Class A, having addresses in the range 1-126 and having a maximum of 16,387,064 hosts. Medium networks are classified as Class B, with addresses in the range 128-191 and with a maximum of 64,516 hosts. Small networks are classified as Class C, having addresses in the range 192-254 with

a maximum of 254 hosts. Addresses are given as dotted decimal numbers in the following format:

nnn.nnn.nnn.nnn

In a Class A network, the first of the numbers is the network number, the last three numbers are the local host address.

In a Class B network, the first two numbers are the network, the last two are the local host address.

In a Class C network, the first three numbers are the network address, the last number is the local host address.

The following table summarizes the classes and sizes:

<u>Class</u>	<u>First #</u>	<u>Max# Hosts</u>
A	1-126	16,387,064
B	129-191	64,516
C	192-223	254

Network mask values are used to identify the network portion and the host portion of the address. For:

Class A - the default mask is 255.0.0.0

Class B - the default mask is 255.255.0.0

Class C - the default mask is 255.255.255.0

Subnet masking is used when a portion of the host ID is used to identify a subnetwork. For example, if a portion of a Class B network address is used for a subnetwork, the mask could be set as 255.255.255.0. This would allow the third byte to be used as a subnetwork address. All hosts on the network would still use the IP address to get on the Internet.

**IP (Internet Protocol)** - a connectionless, best-effort packet switching protocol that offers a common layer over dissimilar networks.

**IPX Protocol (Internetwork Packet Exchange)** - a NetWare protocol similar to the Xerox Network Systems (XNS) protocol that provides datagram delivery of messages.

**IS (Intermediate system)** - a system that provides forwarding functions or relaying functions or both for a specific ATM connection. OAM cells may be generated and received.

**ISA Bus** - a bus standard developed by IBM for expansion cards in the first IBM PC. The original bus supported a data path only 8 bits wide. IBM subsequently developed a 16-bit version for its AT class computers. The 16-bit AT ISA bus supports both 8- and 16-bit cards. The 8-bit bus is commonly called the PC/XT bus, and the 16-bit bus is called the AT bus.

**ISDN (Integrated Services Digital Network)** - an emerging technology that is beginning to be offered by the telephone carriers of the world. ISDN combines voice and digital network services into a single medium or wire.

**ISO (International Standards Organization)** - a voluntary, non treaty organization founded in 1946 that is responsible for creating international standards in many areas, including computers and communications.

**Isochronous** - signals carrying embedded timing information or signals that are dependent on uniform timing; usually associated with voice and/or video transmission.

**Jumper** - a patch cable or wire used to establish a circuit, often temporarily, for testing or diagnostics; also, the devices, shorting blocks, used to connect adjacent exposed pins on a printed circuit board that control the functionality of the card.

**LAN (Local Area Network)** - a data network intended to serve an area of only a few square kilometers or less. Because the network is known to cover only a small area, optimizations can be made in the network signal protocols that permit higher data rates.

**lane** - a program that provides control over the execution of the LAN Emulation Server (LES), Broadcast/Unknown Server (BUS), and LAN Emulation Configuration Server (LECS) on the local host.

**LAN Access Concentrator** - a LAN access device that allows a shared transmission medium to accommodate more data sources than there are channels currently available within the transmission medium.

**LAX-20** - a FORE Systems LAN Access Switch, designed to connect Ethernet, Token Ring, and FDDI LANs to *ForeRunner* ATM networks. The LAX-20 is a multiport, multiprotocol internetworking switch that combines the advantages of a high-performance LAN switch and a full-featured ATM interface capable of carrying LAN traffic.

**Layer Entity** - an active layer within an element.

**Layer Function** - a part of the activity of the layer entities.

**Layer Service** - a capability of a layer and the layers beneath it that is provided to the upper layer entities at the boundary between that layer and the next higher layer.

**Layer User Data** - the information transferred between corresponding entities on behalf of the upper layer or layer management entities for which they are providing services.

**le** - a FORE program that implements both the LAN Emulation Server (LES) and the Broadcast/Unknown Server (BUS).

**LEC (LAN Emulation Client)** - the component in an end system that performs data forwarding, address resolution, and other control functions when communicating with other components within an ELAN.

**lecs** - a FORE program that implements the assignment of individual LECs to different emulated LANs.

**LECS (LAN Emulation Configuration Server)** - the LECS is responsible for the initial configuration of LECs. It provides information about available ELANs that a LEC may join, together with the addresses of the LES and BUS associated with each ELAN.

**leq** - a FORE program that provides information about an ELAN. This information is obtained from the LES, and includes MAC addresses registered on the ELAN together with their corresponding ATM addresses.

**LES (LAN Emulation Server)** - the LES implements the control coordination function for an ELAN. The LES provides the service of registering and resolving MAC addresses to ATM addresses.

**LLC (Logical Link Control)** - a protocol developed by the IEEE 802 committee for data-link-layer transmission control; the upper sublayer of the IEEE Layer 2 (OSI) protocol that complements the MAC protocol; IEEE standard 802.2; includes end-system addressing and error checking.

**LOF (Loss Of Frame)** - a type of transmission error that may occur in wide-area carrier lines.

**looptest** - a program that tests the interface for basic cell reception and transmission functionality. It is usually used for diagnostic purposes to determine if an interface is functioning properly.

**LOP (Loss Of Pointer)** - a type of transmission error that may occur in wide-area carrier lines.

**LOS (Loss Of Signal)** - a type of transmission error that may occur in wide-area carrier lines.

**MAC (Media Access Control)** - a media-specific access control protocol within IEEE 802 specifications; currently includes variations for Token Ring, token bus, and CSMA/CD; the lower sublayer of the IEEE's link layer (OSI), which complements the Logical Link Control (LLC).

**Metasignalling** - an ATM Layer Management (LM) process that manages different types of signalling and possibly semipermanent virtual channels (VCs), including the assignment, removal, and checking of VCs.

**Metasignalling VCs** - the standardized VCs that convey metasignalling information across a User-to-Network Interface (UNI).

**MIB (Management Information Base)** - the set of parameters an SNMP management station can query or set in the SNMP agent of a networked device (e.g., router).

**MIC (Media Interface Connector)** - the optical fiber connector that joins the fiber to the FDDI controller.

**MicroChannel** - a proprietary 16- or 32-bit bus developed by IBM for its PS/2 computers' internal expansion cards; also offered by others.

**MTU (Maximum Transmission Unit)** - the largest unit of data that can be sent over a type of physical medium.

**Multi-homed** - a device that has both an ATM and another network connection, typically Ethernet.

**Multiplexing** - a function within a layer that interleaves the information from multiple connections into one connection. (See demultiplexing.)

**Multipoint Access** - user access in which more than one terminal equipment (TE) is supported by a single network termination.

**Multipoint-to-Point Connection** - a Point-to-Multipoint Connection may have zero bandwidth from the Root Node to the Leaf Nodes, and non-zero return bandwidth from the Leaf Nodes to the Root Node. Such a connection is also known as a Multipoint-to-Point Connection.

**Multipoint-to-Multipoint Connection** - a collection of associated ATM VC or VP links, and their associated endpoint nodes, with the following properties:

1. All N nodes in the connection, called Endpoints, serve as a Root Node in a Point-to-Multipoint connection to all of the (N-1) remaining endpoints.
2. Each of the endpoints on the connection can send information directly to any other endpoint, but the receiving endpoint cannot distinguish which of the endpoints is sending information without additional (e.g., higher layer) information.

**Network Module** - ATM port interface cards which may be individually added or removed from any *ForeRunner* ATM switch to provide a diverse choice of connection alternatives. Each network module provides between one and six full-duplex ATM physical connections to the *ForeRunner* switch.

**NMS (Network Management Station)** - the system responsible for managing a network or a portion of a network. The NMS talks to network management agents, which reside in the managed nodes.

**NNI (Network-to-Network Interface or Network Node Interface)** - the interface between two public network pieces of equipment.

**NuBus** - a high-speed bus used in the Macintosh family of computers, structured so that users can put a card into any slot on the board without creating conflict over the priority between those cards

**OAM (Operation and Maintenance) Cell** - a cell that contains ATM LM information. It does not form part of the upper layer information transfer.

**OpenView** - Hewlett-Packard's network management software.

**OSI (Open Systems Interconnection)** - the 7-layer suite of protocols designed by ISO committees to be the international standard computer network architecture.

**OSPF (Open Shortest Path First) Protocol** - a routing algorithm for IP that incorporates least-cost, equal-cost, and load balancing.

**Out-of-Band Management** - refers to switch configuration via the serial port or over Ethernet, not ATM.

**Packet Switching** - a communications paradigm in which packets (messages) are individually routed between hosts with no previously established communications path.

**PBX (Private Branch Exchange)** - a private phone system (switch) that connects to the public telephone network and offers in-house connectivity. To reach an outside line, the user must dial a digit like 8 or 9.

**PCI (Peripheral Component Interconnect)** - a local-bus standard created by Intel.

**PCM (Pulse Code Modulation)** - a modulation scheme that samples the information signals and transmits a series of coded pulses to represent the data.

**PDN (Public Data Network)** - a network designed primarily for data transmission and intended for sharing by many users from many organizations.

**PDU (Protocol Data Unit)** - a unit of data specified in a layer protocol and consisting of protocol control information and layer user data.

**Peak Cell Rate** - at the PHY Layer SAP of a point-to-point VCC, the Peak Cell Rate  $R_p$  is the inverse of the minimum inter-arrival time  $T_0$  of the request to send an ATM-SDU.

**Peer Entities** - entities within the same layer.

**PHY (Physical Layer)** - the actual cards, wires, and/or fiber-optic cabling used to connect computers, routers, and switches.

**Physical Layer (PHY) Connection** - an association established by the PHY between two or more ATM-entities. A PHY connection consists of the concatenation of PHY links in order to provide an end-to-end transfer capability to PHY SAPs.

**PMD (Physical Medium Dependent)** - a sublayer concerned with the bit transfer between two network nodes. It deals with wave shapes, timing recovery, line coding, and electro-optic conversions for fiber based links.

**PNNI (Private Network Node Interface or Private Network-to-Network Interface)** - a protocol that defines the interaction of private ATM switches or groups of private ATM switches

**ping (Packet Internet Groper)** - a program used to test reachability of destinations by sending them an ICMP echo request and waiting for a reply.

**Point-to-Multipoint Connection** - a collection of associated ATM VC or VP links, with associated endpoint nodes, with the following properties:

1. One ATM link, called the Root Link, serves as the root in a simple tree topology. When the Root node sends information, all of the remaining nodes on the connection, called Leaf nodes, receive copies of the information.
2. Each of the Leaf Nodes on the connection can send information directly to the Root Node. The Root Node cannot distinguish which Leaf is sending information without additional (higher layer) information. (See the following note for Phase 1.)
3. The Leaf Nodes cannot communicate directly to each other with this connection type.

Note: Phase 1 signalling does not support traffic sent from a Leaf to the Root.

**Point-to-Point Connection** - a connection with only two endpoints.

**Primitive** - an abstract, implementation-independent interaction between a layer service user and a layer service provider.

**PROM (Programmable Read-Only Memory)** - a chip-based information storage area that can be recorded by an operator but erased only through a physical process.

**Protocol** - a set of rules and formats (semantic and syntactic) that determines the communication behavior of layer entities in the performance of the layer functions.

**Protocol Control Information** - the information exchanged between corresponding entities using a lower layer connection to coordinate their joint operation.

**Proxy** - the process in which one system acts for another system to answer protocol requests.

**Proxy Agent** - an agent that queries on behalf of the manager, used to monitor objects that are not directly manageable.

**PSN (Packet Switched Network)** - a network designed to carry data in the form of packets. The packet and its format is internal to that network.

**PT (Payload Type)** - bits 2...4 in the fourth byte of an ATM cell header. The PT indicates the type of information carried by the cell. At this time, values 0...3 are used to identify various types of user data, values 4 and 5 indicate management information, and values 6 and 7 are reserved for future use.

**PVC (Permanent Virtual Circuit (or Channel))** - a circuit or channel through an ATM network provisioned by a carrier between two endpoints; used for dedicated long-term information transport between locations.

**Q.2931** - Derived from Q.93B, the narrowband ISDN signalling protocol, an ITU standard describing the signalling protocol to be used by switched virtual circuits on ATM LANs.

**Relaying** - a function of a layer by means of which a layer entity receives data from a corresponding entity and transmits it to another corresponding entity.

**RFCs (Requests For Comment)** - IETF documents suggesting protocols and policies of the Internet, inviting comments as to the quality and validity of those policies. These comments are collected and analyzed by the IETF in order to finalize Internet standards.

**RFI (Radio Frequency Interference)** - the unintentional transmission of radio signals. Computer equipment and wiring can both generate and receive RFI.

**RIP (Routing Information Protocol)** - a distance vector-based protocol that provides a measure of distance, or hops, from a transmitting workstation to a receiving workstation.

**RISC (Reduced Instruction Set Computer)** - a generic name for CPUs that use a simpler instruction set than more traditional designs.

**Router** - a device that forwards traffic between networks or subnetworks based on network layer information.

**SBus** - hardware interface for add-in boards in later-version Sun 3 workstations.

**SAP (Service Access Point)** - the point at which an entity of a layer provides services to its LM entity or to an entity of the next higher layer.



**SAR (Segmentation And Reassembly)** - the SAR accepts PDUs from the CS and divides them into very small segments (44 bytes long). If the CS-PDU is less than 44 bytes, it is padded to 44 with zeroes. A two-byte header and trailer are added to this basic segment. The header identifies the message type (beginning, end, continuation, or single) and contains sequence numbering and message identification. The trailer gives the SAR-PDU payload length, exclusive of pad, and contains a CRC check to ensure the SAR-PDU integrity. The result is a 48-byte PDU that fits into the payload field of an ATM cell.

**SCSI (Small Computer Systems Interface)** - a standard for a controller bus that connects disk drives and other devices to their controllers on a computer bus. It is typically used in small systems.

**SDLC (Synchronous Data Link Control)** - IBM's data link protocol used in SNA networks.

**SDU (Service Data Unit)** - a unit of interface information whose identity is preserved from one end of a layer connection to the other.

**SEAL (Simple and Efficient Adaptation Layer)** - also called AAL 5, this ATM adaptation layer assumes that higher layer processes will provide error recovery, thereby simplifying the SAR portion of the adaptation layer. Using this AAL type packs all 48 bytes of an ATM cell information field with data. It also assumes that only one message is crossing the UNI at a time. That is, multiple end-users at one location cannot interleave messages on the same VC, but must queue them for sequential transmission.

**Segment** - a single ATM link or group of interconnected ATM links of an ATM connection.

**Semipermanent Connection** - a connection established via a service order or via network management.

**SGMP (Simple Gateway Management Protocol)** - the predecessor to SNMP.

**Shaping Descriptor** -  $n$  ordered pairs of GCRA parameters (I,L) used to define the negotiated traffic shape of an APP connection. The traffic shape refers to the load-balancing of a network. In this context, load-balancing means configuring the data flows to maximize the efficiency of the network.

**SIR (Sustained Information Rate)** - the long-term average data transmission rate across the User-to-Network Interface.

**SMDS (Switched Multimegabit Data Service)** - a high-speed, datagram-based, public data network service expected to be widely used by telephone companies in their data networks.

**SMTP (Simple Mail Transfer Protocol)** - the Internet electronic mail protocol used to transfer electronic mail between hosts.

**SNAP** - SubNetwork Access Protocol

**SNMP (Simple Network Management Protocol)** - the Internet standard protocol for managing nodes on an IP network.

**snmpd** - an SNMP agent for a given adapter card.

**SONET (Synchronous Optical Network)** - a new and growing body of standards that defines all aspects of transporting and managing digital traffic over optical facilities in the public network.

**Source Traffic Descriptor** - a set of traffic parameters belonging to the ATM Traffic Descriptor used during the connection set-up to capture the intrinsic traffic characteristics of the connection requested by the source.

**Spanning Tree Protocol** - provides loop-free topology in a network environment where there are redundant paths.

**SPANS (Simple Protocol for ATM Network Signalling)** - FORE Systems' proprietary signalling protocol used for establishing SVCs between FORE Systems equipment.

**SPARC (Scalable Processor Architecture Reduced instruction set Computer)** - a powerful workstation similar to a reduced-instruction-set-computing (RISC) workstation.

**SPE (Synchronous Payload Envelope)** - the payload field plus a little overhead of a basic SONET signal.

**SPVC (Smart PVC)** - a generic term for any communications medium which is permanently provisioned at the end points, but switched in the middle. In ATM, there are two kinds of SPVCs: smart permanent virtual path connections (SPVPCs) and smart permanent virtual channel connections (SPVCCs).

**Static Route** - a route that is entered manually into the routing table.

**STM (Synchronous Transfer Mode)** - a transport and switching method that depends on information occurring in regular and fixed patterns with respect to a reference such as a frame pattern.

**STP (Shielded Twisted Pair)** - two or more insulated wires that are twisted together and then wrapped in a cable with metallic braid or foil to prevent interference and offer noise-free transmissions.

**STS (Synchronous Transport Signal)** - a SONET electrical signal rate.

**Sublayer** - a logical subdivision of a layer.

**SVC (Switched Virtual Circuit (or Channel))** - a channel established on demand by network signalling, used for information transport between two locations and lasting only for the duration of the transfer; the datacom equivalent of a dialed telephone call.

**Switched Connection** - a connection established via signalling.

**Symmetric Connection** - a connection with the same bandwidth value specified for both directions.

**Synchronous** - signals that are sourced from the same timing reference and hence are identical in frequency.

**Systems Network Architecture (SNA)** - a proprietary networking architecture used by IBM and IBM-compatible mainframe computers.

**Tachometer** - in *ForeView*, the tachometer shows the level of activity on a given port. The number in the tachometer shows the value of a chosen parameter in percentage, with a colored bar providing a semi-logarithmic representation of that percentage.

**TAXI** - Transparent Asynchronous Transmitter/Receiver Interface

**TC (Transmission Convergence)** - generates and receives transmission frames and is responsible for all overhead associated with the transmission frame. The TC sublayer packages cells into the transmission frame.

**TCP (Transmission Control Protocol)** - a specification for software that bundles and unbundles sent and received data into packets, manages the transmission of packets on a network, and checks for errors.

**TCP/IP (Transmission Control Protocol/Internet Protocol)** - a set of communications protocols that has evolved since the late 1970s, when it was first developed by the Department of Defense. Because programs supporting these protocols are available on so many different computer systems, they have become an excellent way to connect different types of computers over networks.

**TDM (Time Division Multiplexing)** - a traditional digital multiplexing in which a signal occupies a fixed, repetitive time slot within a higher-rate signal.

**Token Ring** - a network access method in which the stations circulate a token. Stations with data to send must have the token to transmit their data.

**topology** - a program that displays the topology of a FORE Systems ATM network. An updated topology can be periodically re-displayed by use of the interval command option.

**Traffic** - the calls being sent and received over a communications network. Also, the packets that are sent on a data network.

**Trailer** - the protocol control information located at the end of a PDU.

**Transit Delay** - the time difference between the instant at which the first bit of a PDU crosses one designated boundary, and the instant at which the last bit of the same PDU crosses a second designated boundary.

**trap** - a program interrupt mechanism that automatically updates the state of the network to remote network management hosts. The SNMP agent on the switch supports these SNMP traps.

**UBR (Unspecified Bit Rate)** - a type of traffic that is not considered time-critical (e.g., ARP messages, pure data), allocated whatever bandwidth is available at any given time. UBR traffic is given a “best effort” priority in an ATM network with no guarantee of successful transmission.

**UDP (User Datagram Protocol)** - the TCP/IP transaction protocol used for applications such as remote network management and name-service access; this lets users assign a name, such as “RVAX\*2,S,” to a physical or numbered address.

**Unassigned Cells** - a cell identified by a standardized virtual path identifier (VPI) and virtual channel identifier (VCI) value, which has been generated and does not carry information from an application using the ATM Layer service.

**UNI (User-to-Network Interface)** - the physical and electrical demarcation point between the user and the public network service provider.

**UNI 3.0** - the User-to-Network Interface standard set forth by the ATM Forum that defines how private customer premise equipment interacts with private ATM switches.

**UTP (Unshielded Twisted Pair)** - a cable that consists of two or more insulated conductors in which each pair of conductors are twisted around each other. There is no external protection and noise resistance comes solely from the twists.

**VBR (Variable Bit Rate)** - a type of traffic that, when sent over a network, is tolerant of delays and changes in the amount of bandwidth it is allocated (e.g., data applications).

**VC (Virtual Channel (or Circuit))** - a communications path between two nodes identified by label rather than fixed physical path.

**VCC (Virtual Channel Connection)** - a unidirectional concatenation of VCLs that extends between the points where the ATM service users access the ATM Layer. The points at which the ATM cell payload is passed to, or received from, the users of the ATM Layer (i.e., a higher layer or ATMM-entity) for processing signify the endpoints of a VCC.

**VCI (Virtual Channel Identifier)** - the address or label of a VC.

**VCL (Virtual Channel Link)** - a means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

**VINES (Virtual Network Software)** - Banyan's network operating system based on UNIX and its protocols.

**Virtual Channel Switch** - a network element that connects VCLs. It terminates VPCs and translates VCI values. The Virtual Channel Switch is directed by Control Plane functions and relays the cells of a VC.

**Virtual Path Switch** - a network element that connects VPLs, it translates VPI (not VCI) values and is directed by Control Plane functions. The Virtual Path Switch relays the cells of a Virtual Path.

**VPT (Virtual Path Terminator)** - a system that unbundles the VCs of a VP for independent processing of each VC.

**VP (Virtual Path)** - a unidirectional logical association or bundle of VCs.

**VPC (Virtual Path Connection)** - a concatenation of VPLs between virtual path terminators (VPTs). VPCs are unidirectional.

**VPDN (Virtual Private Data Network)** - a private data communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

**VPI (Virtual Path Identifier)** - the address or label of a particular VP.

**VPL (Virtual Path Link)** - a means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

**VPN (Virtual Private Network)** - a private voice communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

**VT (Virtual Tributary)** - a structure used to carry payloads such as DS1s that run at significantly lower rates than STS-1s.

**WAN (Wide-Area Network)** - a network that covers a large geographic area.

**X.25** - a well-established data switching and transport method that relies on a significant amount of processing to ensure reliable transport over metallic media.



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